Arms & Explosives

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CURRENT TOPICS.

An Amusing Blunder.—The Bisley correspondent of the *Times* committed a serious journalistic blunder when he expressed his ignorance of the term "figure of merit," and immediately set to work to interpret values of the same in a reversed sense. On the strength of his Bisley appointment he has often claimed to speak with authority on questions of rifle construction. His subsequent statement that figures of merit do not appeal to the Bisley marksman is somewhat beside the point. If he had only a marksman's knowledge of a rifle it could not take him very far in the discussion of technical questions. It is really a pity that so influential an organ as the *Times* should have been stultified in a matter where accurate press comment might do some good. The War Office maintains a strictly reserved attitude towards newspaper criticism. Yet it is within itself exceedingly sensitive to all that is said concerning its doings. The journalistic *faux pas* which led more than one newspaper to misinterpret the term "figure of merit" caused a rapid shifting of controversial ground when Major Fremantle showed what figure of merit really meant, at the same time indicating the directions in which the published tests were inconclusive and hopelessly at variance with common sense. It seems to us that the most practical procedure in connection with the new shortened rifle would be to continue its manufacture as though nothing had happened, the Small Arms Committee being meanwhile instructed to devise the best available pattern of infantry weapon. A new full-length rifle would in due course be adopted, and the short Lee-Enfields which had by that time been made, could be utilised as carbines. We cannot very well stand still at the present juncture, and it is a pity to delay immediate progress because the War Office is desirous of holding its hand until the age of automatic rifles dawns upon us.

Our Lecture on Trajectory.—In our current lecture we have described the processes which are incidental to the building up of a trajectory curve for any rifle of which certain essential particulars are known. Our lecture is probably unique in so far that it gives in a thoroughly compact form a piece of information which the student would otherwise have to dig out for himself from apparently abstruse military text books. The particulars we have given in the last three lectures are dismissed, so to speak, in the standard text books in the course of a very limited number of pages, which assume the student to be capable of understanding their mathematics without the help of detailed exposition. We do not say that even in the form in which we have expressed ourselves the gunmaker reader will be able to grasp the intricacies of the subject without a good deal of study and calculation. On the other hand, for those who are willing to cudgel their brains we have provided an intellectual feast which will greatly aid them to understand the true meaning of a curve of trajectory. We do not at all hold with the helpless attitude which allows an outside firm to supply the technical particulars of one's own weapons. Self help in this respect requires a great deal of labour, but that labour is well expended by the gunmaker who really aims at the proper interpretation of his weapon. If we turn, for instance, to the table of angles for various military rifles, as

issued by Mr. Gibbs, we find that his second differences are invariably uniform. If, on the other hand, we refer to the table of angles given by Fremantle on page 275 of the *Text Book of Small Arms*, we find that a true table of angles does not show equality of second differences, but only of third differences. This shows that riflemen are at present obliged to be satisfied with rough and ready methods of computation.

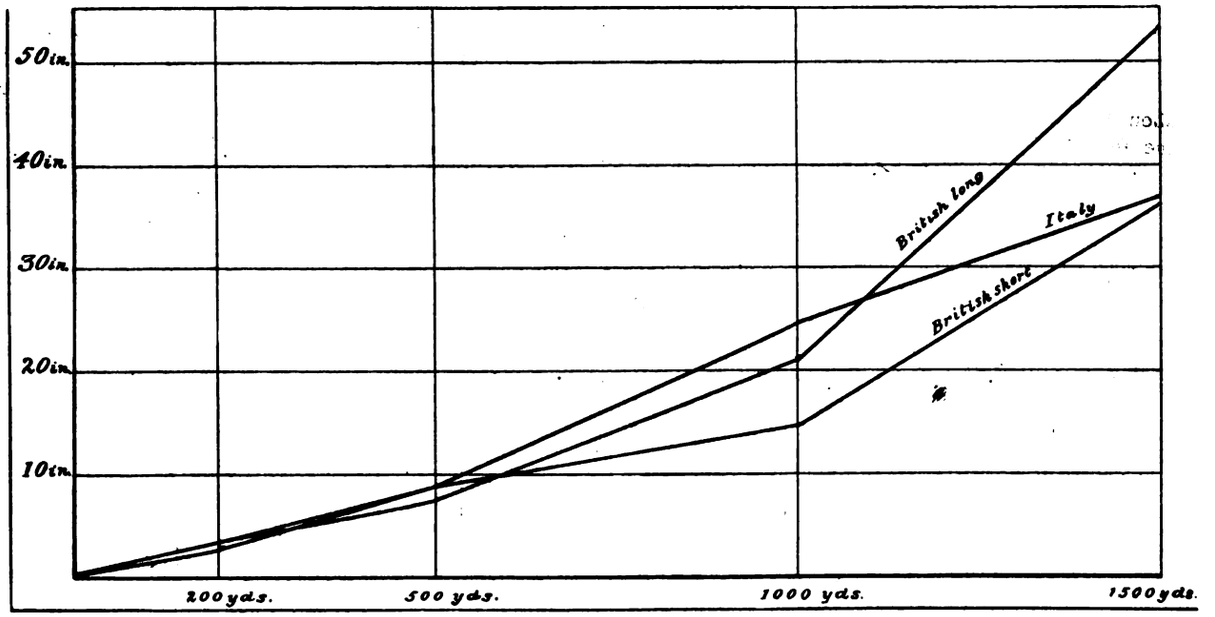
Field and Horse Artillery.—The giving of extensive orders by the Government for new artillery shows that the recent press criticism of our present obsolete armament has effected an exceedingly useful purpose. The South African War has demonstrated most clearly that a gun carriage which contains no recoil-absorbing buffer is slow in action and incapable of firing high-power ammunition. Armstrong, Beardmore and Vickers at once set to work to design a new form of carriage containing the essential properties of the more powerful Continental guns which outclass our present equipment. The merits of the three alternative designs were incorporated by the War Office into a revised pattern of gun, which was recommended for adoption. Change of personality in the War Office led to a sudden swaying of opinion concerning the class of gun which should be used by the field and horse artillery respectively. The previous policy was reversed, and after further consideration the reversed opinion was switched back to the original belief. Here the War Office hesitated and lost a lot of time. The newspapers were successful in putting on the screw by securing definite action on the lines of the original decision. We may accordingly look forward some years hence to the possession of a really efficient outfit of artillery, and it seems that an excellent design of weapon has been secured. The most important lesson to be derived from this experience is that if you want a good arm you should ask a selection of private firms to submit weapons for experiment. The weapons so submitted form the basis of expert tests, whereby the bad points are eliminated, and the most advantageous features of the alternative designs are incorporated into the finally approved model. Had we carried out this same policy in the matter of military small arms, we should doubtless by now possess a weapon having the best features of the Mauser, the Krag and the Mannlicher, to say nothing of the Ross rifle, which is a genuinely British invention, and the outcome of many years of really skilful and practical research.

The Cartridge Trade.—One of the least desirable aspects of the business in sporting cartridges during recent years is the tendency of every manufacturer and loader to give preference to the cheaper makes of cartridge to the exclusion of the best. Their inward conviction must be that second-grade ammunition cannot in the nature of things be equal to the best, and that the shooter who spends thousands a year in the pursuit of his sport would need very little encouragement to patronise the dearer article. The custom has undoubtedly arisen owing to the policy adopted by many firms in their efforts to secure a large turnover under the stress of competition. To do a large loading business they must aim at the production of a cheap cartridge. In their efforts to increase its sale they speak so highly of it that little opening for extra blessings of the superior grade is left. Other firms find it necessary to stock the same quality of material, and they cannot in self-defence condemn it before the buyer. Amidst all this strife the best cartridge has but half-hearted advocacy, and shooters are accordingly prone to adopt the view that the chief difference between best and inferior ammunition is a matter of price. The aggregate loss to the trade must be very serious, and all the more so at a time when cheap quality proprietary goods are distributed at nominal profits. The influence of the gun trade is undoubtedly a very powerful factor in the guidance of sporting opinion, and its members have an excellent case to argue when they urge the sportsman to adopt high-class ammunition. It is with feelings of great doubt and uncertainty that the shooter orders a cheap brand of ammunition. He is not at first satisfied that it shoots equal to the best, and yet he is doubtful about condemning it on his own experience, because sportsmanlike feeling forbids him to attribute bad shooting to his implements. If every gunmaker made himself thoroughly familiar with the connection that exists between first-class materials and first-class results, he could do a great deal to counteract the tendency by which sporting ammunition in cheapened beyond the limit at which efficiency can be ensured. So long, however, as the sportsman finds on every cheap cartridge the implied recommendation of the ammunition maker, the powder maker, and the gun maker, he feels safe in following the dictates of an economical mind.

The New Patent Rules.—The opening of the new year heralds the introduction of a new code of rules relating to the taking out of patents. Two important changes of procedure call for special mention. In the first place the complete specification must be deposited at the office within six months from the date of application. A separate clause provides for the extension of this period to seven months when special reason is shown. This change of regulation will have the advantage of minimising the long delay which is apt to arise between the date of applying for a patent and the publication of details in the complete specification form. A more revolutionary change is embodied in the decision that in future a search will be made to ascertain whether inventions claimed have been wholly or in part anticipated by earlier patents. Notice will be given to the patentee when such anticipation is discovered, and unless the wording or the specification is duly altered, the patent will only be granted after the insertion in the complete specification of a reference to the prior specification by way of notice to the public. The search that will be conducted in reference to every patent so applied for, will not, of course, decide upon its validity or otherwise, that, of course, being subject as formerly to the decision of a court of law. A good deal of adverse criticism has naturally been directed against the principle of a Patent Office Research into the originality of an invention. Nevertheless, a search of the kind proposed will conduce to preventing money from being wasted by the more helpless and ignorant class of inventor. These individuals are frequently the victims of an unscrupulous class, who trap the unwary with specious representations that they are in a position to find a market for miscellaneous inventions. The respectable trader who does not value an idea sufficiently to engage in an expensive search, will again derive great benefit from the official examination, which will be conducted free of extra cost.

THE SMALL ARMS COMMITTEE.

PUBLIC confidence in the Small Arms Committee is not likely to be enhanced by the recent Parliamentary paper which contrasts the shooting of the new shortened Lee-Enfield service rifle with that of other weapons. It seems that the Hythe School of Musketry has spent a certain amount of time in testing the new rifle against not only the old but others of foreign origin. The summation of the accuracy tests is contained in the following table of particulars, which are taken from the original report. It will be seen that we have converted the foot-values of the original table into inches to facilitate their interpretation.



Nationality of Rifle.	Distance in Inches from Centre of Impact at			
	200 yds.	500 yds.	1,000 yds.	1,500 yds.
France	3·96	6·96	15·48	41·04
Germany	4·20	9·24	18·24	48·24
Italy	3·24	8·76	24·48	36·48
Great Britain :—				
(*a*) Long Rifle ..	3·24	7·44	20·64	53·16
(*b*) Short Rifle ..	2·52	8·52	14·52	35·88

We have expressed a selection of the above figures in curve form so that our readers may better appreciate the extraordinary behaviour which is attributed to the different rifles tested. After years and years of work by the Small Arms Committee, this is the best that the Government can tell us to bolster up the waning confidence in the new rifle as a weapon of precision. We have consistently maintained an open mind concerning its potentialities in this respect, but we are at last forced to adopt the conclusion that whether or not the rifle is any good as a target-shooting weapon, the Government, at least, are in a state of blissful ignorance concerning the answer to the conundrum.

One cannot help feeling very severely towards the Small Arms Committee, which ought to have been in a position to give us better technical guidance than is expressed in the accompanying curves of dispersion. It is all very well for the individual members of the committee to shield themselves behind the mistake that was made in the instructions which they received from Lord Roberts before setting to work. They could, at least, have observed sufficient science in their methods to find out exactly how the new rifle compares with other military weapons. That this information has not been obtained is clearly demonstrated by the curves which are now before us. We have held the opinion all along that the personality of the Small Arms Committee was of a kind that is not conducive to the performance of good work. Colonel Hopton, the President of the Committee, is undoubtedly the best possible man for the position, but the other members are not marked by special qualifications for the work. If the Small Arms Committee were reconstituted upon lines conducive to efficiency, its present unwieldly dimensions would be curtailed. A committee of four, with a casting vote for the chairman, would get through a quantity of useful reform work if a proper spirit of enlightened action were infused amongst its members.

With Colonel Hopton as chairman, a perfect representative of the more scientific aspects of rifle shooting would be found in Major Fremantle. There is only one Fremantle in the country, and it is an extraordinary circumstance that the important public services he would be in a position to render are lost to the country by his absence from this committee. The manufacturing element at Enfield would be amply represented by Colonel Hopton, who would be able to secure whatever information that department would be in a position to supply. On the other hand, we

should certainly include in the committee a responsible member of the Birmingham Small Arms Company. They understand the finance and engineering aspects of rifle manufacture and design better than the Government, because they have to carry it out at a profit. No man, therefore, would be better able to do useful work for the committee than the managing director of that company, supposing he were able to accept the nomination. The fourth member of the committee should consist of a practical gun and cartridge expert, having that all-round knowledge which private trade alone can supply.

This committee would then have a really useful equipment of brains for tackling any problem that was brought before it. It would be controlled by an important War Office official, and yet it would be markedly free from the kind of military wrongheadedness which has militated for so many years against the proper development of our small arms equipment. The Gunmakers' Association has emphatically laid down that the new rifle contains the serious structural defects of the older weapon. Manufacturers of the rifle admit that its needless complications of design make it unduly expensive to make and difficult to keep in repair. Ammunition experts have clearly shown that the cartridge is in many respects defective in design. Rifle clubs complain that there is no proper means of obtaining good practice at miniature ranges with the service weapon. There is thus a consensus of opinion, which goes to show that the Small Arms Committee has a large programme of work before it. It can, however, only do that work under an amended constitution. The military element is over suspicious of civilians with any kind of practical knowledge. This they lack themselves, and yet the only kind of civilian help they can tolerate is that of the amiable gentlemen of abstract views who dominates the operations of our learned societies. These men may be splendid on radium and colour photography, but they are not ideal as experts on small arms and ammunition.

NEW PATENT REGULATIONS.

THOSE who are interested in Patent Office procedure will do well to secure a copy of the leaflet entitled "Instructions to Applicants for Patents," the latest edition of which gives a larger amount of information than previous issues, besides covering the new regulations as to time allowed for delivering the complete specification and the newly-adopted search as to novelty. The following abstracts from this document contain information likely to be of interest to our readers:—

Complete Specification.—Unless a complete specification, stamped £3, is left within 6 months, or with extension of time, 7 months, from the date of application, an application for a patent made after the 1st January, 1905, is deemed to be abandoned. The Complete Specification should refer to the number and date of the Provisional Specification, and should be a full and detailed description of the invention, independent of the description given in the Provisional Specification. An extension of time may be allowed for leaving a complete specification (limited to one month), for accepting a complete specification (limited to three months), and for payment of renewal fees (limited to three months). Applications for extension of time must be made on Form U (for leaving the complete specification), on Form V (for accepting the complete specification), on Form K (for the payment of renewal fees), must be duly stamped, and must contain a statement detailing in what circumstances and upon what grounds the extension of time is applied for.

Official Examination.—On the receipt of an application for a Patent, the Examiner to whom the application has been referred will report to the Comptroller whether the nature of the invention is fairly described, whether the application, specification and drawings (if any) have been prepared in the prescribed manner, whether the title sufficiently indicates the subject-matter of the invention, and whether the specification comprises one invention only. If this report be adverse, the Comptroller may refuse to accept the application, or may require that the application, specification or drawings be suitably amended before he proceeds with the application, and he may direct that the application be postdated.

Under Section 1 of the Patents Act, 1902, when a complete specification has been deposited in connection with an application made after the 1st January, 1905, a search is made to ascertain whether the invention claimed has been wholly or in part claimed or described in any specification (other than a provisional specification not followed by a complete specification) published before the date of the application under examination and deposited pursuant to any application in the United Kingdom fifty years next before the date of the application in question. If any such complete or partial anticipation be found and the applicant is unable to amend his specification so as to obviate the necessity for a reference to such anticipation, the patent will only be granted after the insertion in the complete specification of a reference to the prior specification by way of notice to the public. The above search is not, of course, exhaustive, and must not be regarded as being in any way a guarantee of the validity of the patent. See the Patents Act, 1902, and the Patents Rules, 1905. It may be added that the Patent Office does not report as to the patentability of an alleged invention unless its use is contrary to law or morality, or unless it is of an improper nature, or does not relate to a manner of manufacture.

Use of the word "Patent."—Any person who represents that an article sold by him is a patented article when no patent has been granted for it, is liable for every offence on summary conviction to a fine not exceeding five pounds. In a case decided by a Police Magistrate, it was held, however, that a person was entitled to mark goods with the word "patent" after the complete specification had been accepted.

NEW AIR GUN BULLET.—The enterprise and energy which characterise the business methods of Messrs. Lane have found a fresh outlet in the introduction of the Turbite air-gun bullet which is here illustrated on an enlarged scale. The serrated surface enables it to take a nice firm bearing in

the barrel of the ordinary air-gun, whatever may be its peculiarities of diameter and boring. As is well known to users of these weapons the most prolific cause of bad shooting proceeds from the bullet dropping some distance down the barrel, and thereby wasting a part of the propulsive energy of the spring. After carefully testing the new bullet we are able to give it a favourable report for accuracy,

ROUND THE TRADE.

Mr. James Tolley died at Worthing on the 18th ult.

Notice of winding up has been given in the case of the Standard Explosive Co., Ld.

We regret to hear that Mr. Charles Osborne Ellis, of Birmingham, is the victim of a serious attack of illness.

The directors of the Morris Tube Company have declared a six months' dividend at the rate of ten per cent. per annum.

The aged proof master of the Gunmakers' Company, Mr. Spencer, passed away with unexpected suddenness at the turn of the year.

The business of the late Mr. R. Wallis, carried on at 3 Waterloo Bridge Road, has found a purchaser in the person of Mr. D. Williamson.

Colt's Patent Firearms Manufacturing Co. have sent us a notification concerning their change of address from the old premises at Glasshouse Street, to 15a Pall Mall, S.W.

Messrs. William Bennett Sons & Co. have again favoured us with the handsome desk calendar which must by now be a well-known feature in the offices of many of our readers.

The Cotton Powder Company have declared an interim dividend at the rate of seven per cent. per annum on both the preference and ordinary shares for the six months ending October 31, 1904.

His Majesty the King of Portugal, during his recent visit to this country, called at the show rooms of the Wilkinson Sword Co., Ld., and made a careful inspection and test of the sub-target gun machine.

Messrs. Eley Bros., Ld., have sent us fresh samples of their well-known office blotting pad, the characteristic feature of which is a side piece carrying a monthly calendar for the current year and a ground glass memorandum pad.

The annual meeting of the City of London Rifle Association led to the announcement that the membership had substantially increased during the past shooting season, and that the association was generally in a very satisfactory condition.

Mr. F. Marten Hale recently contributed a letter in the correspondence column of the *Globe*, calling attention to the advantages that arise in the use of guncotton explosive charges in bulk as distinguished from the same material built up in sections.

We have received from Messrs. Ludw. Loewe & Co., Ld., their uniquely instructive and well-illustrated catalogue of small tools, cutters, reamers, taps and gauges which should be in the hands of every firm who favour the latest developments of modern machine shop practice.

Messrs. Charles Osborne & Co., Ld., have forwarded to this office the 1905 edition of their comprehensive catalogue of guns, rifles, pistols, implements and sundries. Its excellent illustrations and completeness of information are too well known to require any detailed reference in this connection.

A company entitled Herculite No. 2, Ld., has been formed to acquire certain rights from Mr. H. Boyd, in reference to an invention of an explosive known as "Herculite." Mr. Boyd has been concerned with similar promotions connected with explosives known respectively as Ripp-lene and Fume-lessite.

The handbook issued by the Ideal Manufacturing Company, U.S.A., giving instructions concerning the re-loading of military cartridges for practice purposes seems to show that in America, at any rate, they believe in taking a little trouble to secure a reliable and inexpensive form of practice with the service rifle.

Mr. H. J. Poulter, the well-known maker of rifle targets, has issued a notice advising his customers of his removal to larger and more convenient premises, viz.: Armoury Printing Works, Midland Road, Leyton, E. The same circular states that future home orders amounting to ten shillings and upwards will be sent carriage paid.

Mr. Bromley Davenport, M.P., financial secretary to the War Office, assured a deputation of tradesmen and others from the neighbourhood of the Enfield factory, that he would do all in his power to forward a scheme that would ensure steadier work in the future, and prevent the frequent discharges of workpeople from the factory.

On the occasion of his 80th birthday, Mr. John Deeley was the recipient of an illuminated address presented to him, on behalf of the employees of the Westley Richards Company, by the managing director, Mr. L. B. Taylor. This is a fitting tribute to one who has a record of 65 years' service, more than half of which was devoted to the interests of this firm.

The determination of the Union Metallic Cartridge Company to hold the premier position in the market for miniature rifle ammunition is shown by their recent announcement of important reductions in the price of various rifle cartridges. Their justly celebrated ·22 short smokeless cartridges can now be purchased at the low wholesale rate for large quantities of eleven shillings a thousand.

We understand that Mr. Robert J. Hill, who was for many years with the firm of John Hall & Son, and has since occupied an important position in the managerial department of the Roskear Fuse Works, has joined his brother in business at Baltic Chambers, Bishopsgate Street Within, under a partnership styled Fredk. A. Hill & Co. The business is well known as an agency for explosive materials.

The Hoyt Metal Company of St. Louis, U.S.A., have sent us a pamphlet descriptive of a new form of clay-bird trap. Judging from the description and illustrations, it seems to be a sound and practical piece of work. It is made in two forms, viz.: the ordinary trap for common or garden use, and a club trap which is operated by a lever from the firing point, the attendant having only to slip fresh birds into the hand of the trap.

The Du Pont Powder Company have sent us a calendar depicting the retrieving of a duck from amongst the marsh reeds into which it has fallen, no doubt after having been shot by the firm's nitro-explosive. The Laflin and Rand Company have similarly sent us a weird colour printing effect in which we see a realistic piece of rifle shooting by a sportsman standing in the stem of a Canadian canoe. The reflected shadows of the silhouetted mountains are particularly effective.

A recent issue of the *South African Journal* contains an interesting article concerning the establishment of an explosives factory in Mexico. It is to be carried on as the Compania Nacional Mexicana de Dinamita y Explosiva, and it is situated at a place called Tinaja in the Partido of Mapimi in the State of Durango, and at no great distance from the Central Mexican Railroad. This seems to be favourably placed with regard to the mining district. The factory buildings will include an acid works.

The *Times* of December 23rd last contains a letter signed by Capt. Edward Scrope Shrapnel, of the Vancouver Island veterans, in which he declares himself the eldest surviving grandson of General Shrapnel, the inventor of the shell bearing his name. While we sympathise very fully with the complaint that adequate remuneration was not granted to the inventor of this important contrivance, we can hardly regard the destitution of grandchildren as directly arising from the financial embarrassment of their grandparent.

As the *Money Maker* points out, the Peddie Small Arms Company is a type of the immensely speculative industrial new issue which in nine cases out of ten is very dangerous to the ordinary investor. The payment of £2,000 in cash and £8,200 odd in shares, for a patent which our contemporary points out may be an absolute unqualified commercial failure, is quoted in support of the above stinging condemnation of the new promotion. Our readers will no doubt call to mind many instances of failure amongst companies which have been formed to exploit minor improvements of detail in military firearms. The *Financial News* states that the prospectus is one which will not bear commonsense criticism. The *Financial Times* is equally dubious of the Company's chance of success.

THE PISTOLS ACT.

THE Chairman of the Birmingham Gunmakers' Association echoed the views of the large majority of the trade when he pointed out in a recent speech that the working of the Pistols Act has inflicted a very serious injury upon a perfectly legitimate trade. One of the most unfortunate aspects of our national legislature is that it is in the hands of a body of gentlemen who have little or no practical knowledge of business matters. It will be remembered that the Earl of Donoughmore was the noble peer who was entrusted with the conduct of the Pistols Bill through the House of Lords. His acquaintance with practical business matters is doubtless an insignificant quantity; at any rate we do know for a fact that he was under the impression that the Pistols Bill was in complete sympathy with the views and wishes of gunmakers, and he treated with polite disbelief any expressions of opinion to a contrary effect.

The result was the passing into law of an enactment which, while aiming at regulating the distribution of pistols so as to place obstacles in the way of undesirable persons obtaining possession of the same, was so framed as to be equally severe on those having a legitimate use for pocket firearms. The clauses which prohibited the sale of pistols to youths and other persons having no proper justification for possessing them, were quite proper and necessary. But when it came to framing the conditions under which pistols might be purchased for legitimate uses, the sponsors for the bill introduced a number of provisions which were too complicated and too bureaucratic to give good results in a country such as ours. The net result of the Act in its working form is well known to every gunmaker whose business includes traffic in this class of firearm. The complications incidental to the purchase of a pistol by a person having a legitimate use for it are such that the would-be buyer elects either to go without or to postpone the transaction until he reaches a country less addicted to grandmotherly legislation.

In the Explosives Act we have an excellent example of a piece of highly-restrictive legislation, which is carried out with the most scrupulous regard for the financial interests of the important firms concerned. By the simplest procedure the officials charged with the regulation of the explosives industry can make any needed changes in the method of carrying out the spirit of the original Act. Their efforts are always directed towards perfecting the arrangements which tend to safeguard explosive workers on the one hand, and the general public on the other. Whenever any hitherto unsuspected source of danger is brought into prominence, fresh rules are drafted to govern the procedure of the manufacturer, the carrier, or the storer. When there is reason to believe that trade convenience will be affected, the Home Office officials are in the habit of inviting expressions of opinion before any definite step is taken. In due course the new regulation is issued in the form of an Order in Council, and this has the same effect as any part of the original Act. The most we ask in the matter of revising the Pistols Act is that the clause which notifies the conditions under which pistols may be purchased should be so altered as to give the Home Secretary power to make such regulations as may from time to time seem desirable for the registration of dealers and the general supervision of the sale of pistols.

TESTS OF POWDERS.

THE *Field* reproduced in a recent issue the results of an exceedingly interesting series of experiments which had been conducted to determine the relative rate of ignition of different smokeless powders. It showed that granted good caps the difference between the quickest and the slowest smokeless powder amounts to little more than the four-hundredth part of a second. This tends to discount in a great measure the opinions which are so frequently expressed by individual sportsmen concerning the quickness of their own particular favourite among the nitros. Though it has been clearly shown that the relative rate of ignition is not a material factor in a properly loaded and properly regulated nitro powder, it is nevertheless certain that there must be a scientific basis for the property which the shooter describes as quickness on the bird.

It does not at all follow that the sensation of quickness involves a time element of any kind. The shooter pulls the trigger, and he is conscious of a sympathetic response on the part of his gun. He is also aware that the effect on the bird lacks nothing in promptness. Now it is quite possible that a clean-killing cartridge will impart the impression of quick action much more effectively than a really sharp brand of ammunition which is lacking in killing power. Then again it may well happen that there is something in the characteristic recoil of a given nitro powder, which is more pleasing to the sensations of the shooter than that of another powder, equally good in all other respects. Powders of the 33-grain type, also condensed powders requiring a small weight of charge to produce the standard result, seem to be especially favoured by the flattering reports of their users. There can be no doubt that these powders are characterised as a class by a low muzzle pressure. This has its due influence on the manner in which the products of combustion are ejected from the muzzle following the departure of the shot-charge. That is to say, their kick-stage of recoil is less marked than with powders of the older kind. If the shooter's senses are so attuned to the action of his cartridge that he can distinguish between one kind of recoil and another, it is quite possible that the powder he prefers is fundamentally the best.

So far as instrumental tests go, their results are absolute and scientific; but it does not always follow that the foot-seconds and tons-pressure standards of perfection are the best for the sportsman. A very obvious example of this antagonism between laboratory tests and sporting needs may be quoted without going back many years. We were all educated into the belief that the best smokeless powder was the one that had the lowest pressure, and manufacturers vied with one another in showing that their individual product gave low results in this respect.

A relic of this barbarous notion is still to be found in the announcement that Cooppal powder gives a pressure of 1·6 tons. In point of fact it gives three tons, and the company would find considerable difficulty in selling a canister of powder a year giving the results claimed. Mr. Borland was the first to recognise that the best all-round powder was the one giving so high a pressure that the results should not be absolutely futile, in a cartridge having little or no turnover. In due course a chamber pressure of three tons was advocated, and this is now a recognised essential.

LECTURES TO YOUNG GUNMAKERS.

XXXIII.—THE CALCULATION OF TRAJECTORY.

As a means of introducing our demonstration of the shooting method of obtaining information concerning trajectory we will proceed to show how tables of angle can be obtained. For ranges at which rifles are shot, say up to 1,500 yards, it is desirable to adopt a method which is characterised by simplicity as well as accuracy. These conditions are met by the use of the so-called "Hadcock's table of double entry." This table is called Table K in the new *Text Book of Small-Arms*, and Table X in the latest edition of the *Text Book of Gunnery*. If we turn to the table in question we shall find that it gives certain arithmetical values appropriate for a large number of combinations comprising the velocity of the shot on the one hand and the range of shooting on the other. The velocity column is graduated in rises of 10 feet at a time. The different ranges specified vary from 100 to 5,000 yards advancing 100 yards at a time. From the values given in this table the angle of fire can be deduced for any given projectile according to its initial velocity and the range.

As projectiles differ very much in their characteristics this table has been calculated for one kind of projectile only. The one selected is that which has a ballistic co-efficient equal to unity. Our lecture in the November issue showed that the ballistic co-efficient of a projectile is equal to its weight, divided by the square of its diameter and by *c* which is termed the co-efficient of reduction. The values given in Hadcock's table are usually denoted by the letter *a* when used in formulæ, and they represent half the tangent of the angle of elevation which is necessary for the stated combinations of range and velocity. If, therefore, the bullet under consideration has a different ballistic co-efficient from that assumed in the table special manipulation is necessary, and it will be for us to explain how this manipulation is to be effected.

To make the use of Hadcock's table perfectly clear we give here the behaviour of the ·303 rifle as an example. The weight of bullet *w* equals 215 grains. Its diameter *d* after leaving the muzzle may be taken at the average value of ·308 in. The co-efficient of reduction, which was explained in our November issue, and denoted by the letter *c*, equals ·78, and the muzzle velocity has been taken for the purposes of this demonstration as 2,030 feet per second.

$$\text{Then} \quad c = \frac{w}{c\,d^2} = \frac{215}{7000 \times \cdot78 \times 308^2} = \cdot415$$

This calculation shows us how to obtain the ballistic co-efficient of a bullet when we know the value of its co-efficient of reduction and the particulars as to diameter, weight, etc., as given above. Knowing the value of c the accompanying table shows how the Hadcock values may be used to indicate the behaviour of the ·303 rifle for the ranges between 100 and 1,000 yards. The first column represents the series of ranges for which we desire to ascertain the angle of fire. With a ballistic co-efficient of ·415 we must convert the actual range into the so-called "reduced range." That is to say, if we divide 100 yards by ·415, the answer is 241 yards. We thereupon turn to the velocity 2,030 feet in Hadcock's table and we find that the values are given for nothing between 200 and 300 yards.

Ranges in Yards.	"Reduced Ranges," *i.e.*, $\frac{R}{C}$	Table Values of "*a*."	Tangent of Angle, $\frac{1}{2}C \times a$.	Angle.
100	241	·0061	·00127	4·5′
200	482	·0128	·00266	9·2′
300	723	·0207	·00430	14·8′
400	964	·0301	·00624	21·4′
500	1,203	·0411	·00853	29·4′
600	1,446	·0538	·01126	38·7′
700	1,687	·0681	·01413	48·5′
800	1,928	·0842	·01747	1° 0·2′
900	2,168	·1017	·02110	1° 12·5′
1,000	2,409	·1204	·02513	1° 26·4′

A sum in simple proportion enables us to fix ·0061 as the appropriate table value of *a* for 2,030 ft. velocity having ·00496 and ·00758 as the values for 200 and 300 yards respectively. The fourth column of the table shows the table value reduced to the tangent of the angle of elevation. The needful conversion is effected by multiplying half the value of c by the figure taken from the table. We showed in our last lecture that the conversion of the tangent of an angle into actual degrees and minutes of angle may be effected either by the use of a table of natural tangents, or else by converting tangents into drop, and drop into minutes of angle. It was, however, made clear in the previous lecture that as trajectory tables deal only with the drop of the bullet the actual angle is not required, except as an instruction to the rifleman concerning the elevation of his sights. The angle itself is given in the last column as 4·5 minutes. Fremantle gives this angle as 4·4 minutes, but we need not devote time to a difference equal to one-tenth of an inch at 100 yards. The above table shows that for 1,000 yards the angle is 1° 26·4′. Fremantle's value is 1° 28·1′. Here again we waive a difference of 1·7 minutes of angle, which is equivalent to 17 inches at 1,000 yards. That some difference between the two tables must exist is evident from the fact that Fremantle's figures assume a muzzle velocity and co-efficient of reduction not the same as ours. In actual shooting the characteristic angle, as obtained from calculated tables or from actual shooting, supplies a general index as to the behaviour of the rifle. It is, however, only by the taking of trial shots that the shooter will be able to make the final adjustment of aim suited to the conditions that exist for the moment in the particular rifle and cartridge he is using.

Having obtained the above table of angles by using ·78 as the value of the co-efficient of reduction of the ·303 bullet, it must be apparent that we can work backwards from an ascertained angle of fire for a strange bullet, and so determine what is the value of the coefficient of reduction that agrees with the elevation found by experiment. To demonstrate this relation is the main object of the present series of lectures on trajectory. The gunmaker wishes to ascertain the behaviour of a given combination of cartridge and rifle. His analysis of its action must eventually take the form of a properly calculated table of trajectory. This he cannot obtain by

experiment alone. Consequently his first care must be to ascertain what value of co-efficient of reduction agrees with the results of his firing experiments at a selection of ranges. It is almost useless to attempt to obtain a reliable angle of fire from shooting carried out at a less distance than 1,000 yards. It is accordingly necessary to fit a rifle with a proper set of match sights, the same to be capable of showing the true angle of elevation with reference to the zero of the rifle, which latter must be ascertained in the usual manner. By firing at 1,000 yards, and noting the angle of elevation necessary to hit the target, a rough idea of what is wanted may be obtained. A further refinement consists in determining the centre of the group of shots and in noting the displacement of this group from the point aimed at, and correcting the angle to this extent.

To determine the value for the co-efficient of reduction we will assume that the angle found by an experiment with the ·303 rifle is the above 1°28′, as obtained by Fremantle working on the lines laid down by Mr. Metford. If we carry out our calculation upon the assumption that the co-efficient of reduction due to air resistance is unity we shall find that this gives a greater angle than that obtained by experiment. We may then substitute ·9 and so make a fresh calculation. The accompanying table shows three test values worked out in this way.

$c=1{\cdot}0$	$c={\cdot}324$	$\frac{R}{C}=3{,}088$	$\therefore$ Angle $=1^\circ\ 44'$
$c={\cdot}9$	$c={\cdot}360$	$\frac{R}{C}=2{,}778$	$\therefore$ Angle $=1^\circ\ 24{\cdot}5'$
$c={\cdot}8$	$c={\cdot}405$	$\frac{R}{C}=2{,}470$	$\therefore$ Angle $=1^\circ\ 28'$

From these it is apparent that the value of *c* for the angle adopted is exactly ·80. This shows a slight difference between the value we adopted, viz., ·78, and indicates that ·80 is a more correct value for Metford's table than ·78. Having by this means ascertained the value for *c* which corresponds to the angle of elevation for 1,000 yards, we can build up with the help of Hadcock's table a series of angles appropriate for every other range. This in fact is where the great utility of Hadcock's table comes in. We first obtain one value by experiment, and we can then deduce the value of *c*, the co-efficient of reduction, and work out the angles for a complete series of distances, and then test them by actual shooting.

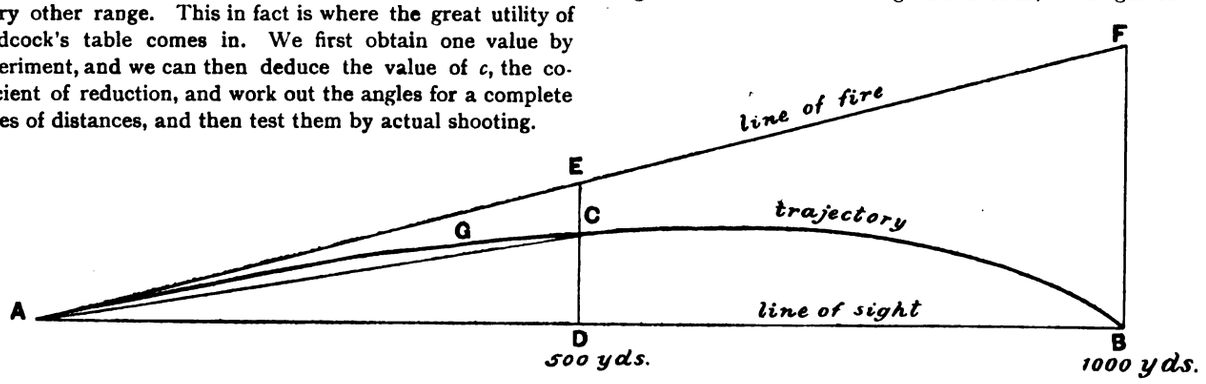
bullet. A necessary, but somewhat misleading, aspect of a sketch of this kind consists in the fact that the height of the diagram must be given on a much larger scale than the horizontal dimensions. The line A B, as already stated, represents 1,000 yards. The vertical line, on the other hand, is actually less than 80 ft., and if in true proportion it would be only one-sixth of an inch high. A right-angle triangle with a 1,000 yards base and a vertical side 80 ft. high is a very simple figure to consider from a geometrical standpoint. The length of the line A F may for all practical purposes be considered as equal to the length of the line A B, this being true for the angles that are used in ordinary rifle shooting, which we may consider as not greater than two degrees of arc. On the same basis of reasoning the length of the line A C is equal to that of the line A D. To ascertain the height of the line E D knowing, as we already do, the tangent of the angle F A B, we must multiply the tangent by the distance A D, viz., 1,500 ft. This may be set down algebraically as follows:

$$\text{A D} \times \tan \text{F A B} = \text{E D}.$$

The straight line A C, which is drawn from the apex of our angle to the point where the trajectory cuts the line E D, shows us the relation of the trajectory curve to the line of sight when firing at 500 yards. Having by the above calculation ascertained the height of the line E D, we now wish to find the value of the distance E C, this being the drop of the bullet at 500 yards when shooting at 1,000 yards. We now turn back to Table I. and we see in the fourth column what is the tangent of the angle of fire at 500 yards. This is the angle C A E in the above diagram. Therefore the distance A C, which is 1,500 ft. multiplied by the tangent of the angle C A E, gives us the distance C E, the drop of the bullet at 500 yards when shooting at 1,000 yards. This is expressed algebraically in the following manner:

$$\text{A D} \times \tan \text{C A E} = \text{C E}.$$

Having split the line R D into two component parts E C and C D we know the drop of the bullet at 500 yards and also the height of the trajectory at the same distance. In other words, the height of the trajectory is the distance E D minus the height C E. Put in correct algebraical form, the height of the



The next item in our demonstration will be to show how we can extend Table I. so as to indicate the height of the curve of trajectory at any and every point from the muzzle of the gun to the 1,000 yards target. The accompanying diagram illustrates in the conventional manner the aspects of a trajectory curve which must be clearly understood by the student. The distance A B is the range of 1,000 yards. A D represents 500 yards, and the curve indicates the course followed by the trajectory at 500 yards when shooting over 1,000 yards is in feet

$$1{,}500 \times \tan \text{F A B} - 1{,}500 \times \tan \text{E A C}.$$

The proper understanding of this process of analysing a trajectory curve will enable us to obtain from the figures given in Table I. the height of the trajectory at every distance between the muzzle and the target when shooting over a given distance. The accompanying table accordingly repre-

sents the method of arriving at these particulars in reference to the ·303 bullet when fired over a range of 1,000 yards.

Distances.	Drop in feet (tan of angle × range).	Distance from line of fire to line of aim.	Height of trajectory.
100	0·381	7·539	7.158
200	1·596	15·078	13·482
300	3·870	22·617	18·747
400	7·488	30·156	22·668
500	12·795	37·695	24·900
600	20·268	45·234	24·966
700	29·693	52·773	23·070
800	41·928	60·312	18·384
900	56·970	67·851	10·881
1,000	75·390	75·390	nil

The first column of the table shows the usual series of distances. The second column contains the values of drop; that is, the tangent of the angle for each range multiplied by the range value in feet. This gives the height E C not only for 500 yards, but also the equivalent for every other distance between the firing point and the target. The third column gives us the distance separating the line of fire from the line of aim at the different distances under consideration, that is, the height of the line E D at 500 yards and similar heights for the other ranges. By subtracting the values in the second column from those in the third we obtain the height of the trajectory at every 100 yards when shooting over the 1,000 yards range.

A CLEANING PREPARATION.

THE South British Trading Company recently forwarded for our inspection a tube of brown paste, which is an American preparation for metal polishing. The remarkable property which is possessed by this material is that it seems to be capable of dissolving iron rust.

We took a number of iron and steel implements which had become badly discoloured by rust. Gentle friction with a rag smeared with the paste was markedly successful in dissolving the oxide and putting a polish on the underlying metal. Obviously, the material could not scour away the metal so as to remove the rust pits, but it certainly was remarkably successful in removing the untidy appearance of the rust. The action of the paste is apparently too rapid to be accounted for by the mechanical action of a fine scouring material: the effect seems to be chemical rather than mechanical. As the polishing material is equally applicable to soft metals, it seems well suited for restoring the surface of nickel-plated revolvers and other metal goods which are liable to lose their fine surface by the exudation of rust through the pores of the overlying metal. We tried the metal cleaner on the bore of a rifle which, though comparatively new, had been neglected on one occasion, and had caused never-ending trouble since by the obstinacy of the rust and its renewed growth when the rifle was put aside. The rust remover, when applied on a bristle brush, seemed to break down the rust so that the bore could be polished out quite clean by the subsequent use of rag patches. We have applied the same treatment to other rifles and we have found no tendency for fresh rust to develop.

CORRESPONDENCE.

AMERICAN PRACTICE CARTRIDGES.

TO THE EDITOR OF *Arms and Explosives*.

SIR,—In your Nov. issue, under the above heading, you say in your Editorial footnote that "had you known the new ammunition was of the 'reduced type,' of a kind to be used for *gallery shooting*, you would not have ridiculed the idea of a great gain in cheapness."

Now, the ·32-40 cal. Kynoch cordite cartridge, with 185-grain nickel base bullet, gives a muzzle velocity of 1,440 ft.-sec., and you would hardly call this a "gallery cartridge," yet you do so to the reloaded U.S. Government cartridge, with a hardened bullet of 178 grains and about 1,500 ft.-sec. muzzle velocity. This causes a prejudice to these reloaded cartridges amongst a lot of people who do not understand what they will really do, and up to what ranges they are accurate. I have tried reloading the ·303 cartridge, and have got good results up to 200 yards with a 125-grain bullet (hardened with tin, 1 to 10) and 8 grains, by weight, of E.C. No. 3 Smokeless Shot-Gun Powder (this is about equal to 20 grains of black powder). I have also used Kynoch's cordite reduced charge cartridge with nickel-base hard lead bullet. This shoots well up to 400 yards with a fair wind and up to 500 yards in calm weather; but, of course, it is much more expensive than a reloaded one. I enclose a small book issued by the Ideal Manufacturing Co., on the reloading of Government rifle cartridges, which may interest you, if you have not already seen one. Personally, I think this style of ammunition is the very thing for training beginners with the service rifle. Young fellows who have never shot anything larger than a ·22 cal. are apt to flinch at the recoil of a full charge cartridge. I have seen this many times when watching volunteer recruits firing, therefore I think a reduced charge reloaded cartridge, which, by being very cheap, would allow a good number of rounds to be allotted to recruits, is the very thing to break them gradually into the easy and confident handling of the rifle, which is so necessary to good shooting. Cartridges could be reloaded at a total cost of 2s. 6d. per 100.

Yours faithfully,

Bradford, Dec. 15, 1904. C. H. MANN.

THE NEW SERVICE RIFLE.

TO THE EDITOR OF *Arms and Explosives*.

SIR,—Would you please explain to me in a simple way the progress of the bullet as it passes through the barrel of the Lee-Enfield short rifle, so that the bullet leaves with the same muzzle velocity as from the Lee-Enfield Mark II., or, in fact, those arms with the longer barrel. My method of explaining this question, after reading the paragraph on "Barrel" in the *Text Book on Small Arms* (Page 72), is that the increased diameter of bore and increased depth of rifling have been so mathematically worked out, that the explosion, acting on the base of bullet, takes the same time to force the bullet through the barrel owing to this increase of diameter of bore and depth of rifling having to expand bullet to barrel at muzzle end. I am afraid you will not think this very clear,

for I always feel that there is something behind all this which I cannot fathom. Since subscribing to your valuable paper, which was brought to my notice by a friend at the Artillery College, I have learned much valuable information from your "Lectures to Young Gunmakers," especially last month's, for, as Armourers, we get no lectures on even what I may term the very elementary elements as regards the various forces which take place when a shot is fired and during its passage through barrel and flight through the air. Trusting I am not encroaching too much on your very valuable time and generosity,

ARM. STAFF SERGT., R.G.A.

Sheerness, Jan. 2, 1905.

[The text book says, "The grooves of this rifle are of the same shape as the Enfield rifling, but the bore increases in diameter and the rifling in depth towards the muzzle. This gives the rifle the same velocity as the Lee-Enfield rifle." If this represents the whole of the facts, we must assume that the gain in velocity is brought about by reduced friction due to the enlargement of the bore. Neither this, nor the increased area of the cross-section of the bore, would, in our opinion, neutralise the loss of the five inches of barrel. The shortened lead, about which the text book is discreetly silent, accounts in our opinion for the relative gain of velocity. By increasing the initial resistance to the bullet's entry into the barrel, the powder pressure is raised and a greater propulsive force is exerted on the bullet. We believe the bell-mouthing of the barrel was introduced as a remedy for metallic fouling, but a new use for it seems to have been found.—ED.]

TRADE MARKS

ADVERTISED. NOV. 30—DEC. 21, 1904.

266,223. A half-tone reproduction of his portrait. Lincoln Jeffries, Birmingham. To apply to ammunition. September 14, 1904.

265,774. The word KORNIT. To apply to arms. J. A. Tickner, London. August 24, 1904.

267,019.) A reproduction of the well-known device representing a
267,020.) gripped hand from which electricity emanates. To apply to cartridges and cartridge cases. The Schultze Gunpowder Co., Ld., London. October 12, 1904.

217,110. The word SPORTMANTEAU. To apply to goods in Class 19. H. Holmes, London. October 17, 1904.

REGISTERED. NOV. 17—DEC. 8, 1904

266,007. Kynoch Ld.

266,428. H. de M. Smell.

APPLICATIONS FOR PATENTS.

NOVEMBER 21—DECEMBER 17, 1904.

25,241 Range Finder. C. & H. C. Beck.

25,347. Ejector Mechanism for Small-arms. T. D. Cross and H. Jones.

25,398. Explosives. The New Explosive Co. Ld., and J. C. Ody.

25,526. Feed of Automatic Guns. A. T. Dawson, and G. T. Buckham.

25,584. Sights for Fire-arms. W. Meeson.

25,609.* Semi-Automatic Rifle. M. F. Smith. (Date of application in U.S.A., November 25, 1903).

25,797.* Explosives. J. Y. Johnson (Agent for *Soc. Anonyme des Poudres et Dynamites.*)

25,822. Small-arms Sights. A. Tunstall.

25,987. Gas Expulsion from Guns. J. D. Edwards and C. C. Love.

26,050.* Single-trigger Mechanism. F. Beesley.

26,131. Targets. W. Bailey.

26,135. Small-arms. J. B. Thorneycroft, M. G. Farquhar and A. H. Hill.

26,146. Explosives. Curtis's & Harvey's Ld., and A. F. Hargreaves.

26,189.* Torpedo Launching Apparatus A. E. Jones.

26,205. Sights. P. R. J. Willis (Agent for *K. Tideman & B. Culver*).

25,229. Air-gun Target. D. Ashton

26,288.* Laying Heavy Ordnance. Vickers Sons, & Maxim Ld., A. D. Williamson and C. L. Sumpter.

26,362. Projectiles. H. W. Holland, and T. Woodward.

26,377. Working of Ordnance. A. T. Dawson and J. Horne.

26,476. Rifle Sights. T. Mitchell and J. Hodgson.

26,480. Range Finder. R. H. Owen.

26,728. Shells. W. S. Simpson.

26,762. Field Gun Carriages. A. T. Dawson and G. T. Buckham.

26,775. Projectiles. W. Strickland.

26,793. Fire-arms. H. P. Okie.

26,967. Magazine Rifle Mechanism. L S. Hollings.

26,974. Explosives. A. C. Luck.

27,005. Priming Composition. J. Wetter (Agent for *Westfälisch Anhaltische Sprengstoff-Akt.-Ges.*)

27,162.* Explosives. C. A Allison.

27,166.* Explosives. L. Lheure

27,167.* Detonating Tubes. L. Lheure.

27,178. Ordnance. F. Krupp Ag. (Date of application in Germany, March 11, 1904.)

27,239. Submarine Mines. E. T. Whitelow and G. H. Scholes.

27,344. Range Finder. J. G. Baker.

27,459. Explosives. L. Lheure.

27,460. Primers. L. Lheure.

27,581. Telescopic Sights for Ordnance. A. König.

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

DECEMBER 1st—DECEMBER 22nd, 1904.

COMPILED BY HENRY TARRANT.

19,096 (1903). **Automatic Rifle Mechanism.** T. R. R. Ashton, London. Improvements in automatic rifle mechanism, intended to attain great rapidity of firing without complication of parts, and to allow of the weapon being used as an ordinary hand operated arm. The rifle is of a type in which the gas escapes radially through the wall of the barrel after the projectile has passed a certain point. Accepted November 4, 1904.

20,272 (1903). **Back-sight for Rifles.** R. A. Rogers, and F. Cantels, Isle of Wight. In the bar sliding on the ordinary type of back sight leaf, a slot is cut. Working in this slot is a V-carrying part, which may be shifted laterally to counteract the effect of wind on the bullet. Accepted November 21, 1904.

21,481* (1903). **Perchlorate of Ammonia Explosive.** F. E. W. Bowen, London.

21,482* (1903). **Propellant Explosive.** F. E. W. Bowen, London.

25,682 (1903). **Range Finder.** Sir H. Grubb, and G. R. Grubb, Dublin. A range finder, adapted to be used either for long or short distance finding, in which two part images of the object are seen, one directly and the other by reflection. These part images are brought into exact juxtaposition by an adjustable optical device so that they can be viewed as a complete image of the object. The extent of the movement of the optical device determines the range of the object. Accepted November 24, 1904

26,239 (1903). **Wind Gauge Rifle Sights.** J. B. Thorneycroft, Manchline, and M. G. Farquhar, Aboyne. A wind gauge sliding on the free end of a leaf sight of the new service type, is adapted automatically to be returned to the zero position when the leaf is closed down on to its bed. Accepted November 10, 1904.

27,515 (1903). **Safety Explosive Compounds.** H. H. Lake, London. (Agent for the *Cyanid Gesellschaft mit Beschränkter Haftung, Germany*). In order further to safety explosive compounds, cyanamides are used. Cyanamides, *i.e.*, cyana-

mide, dicyandiamide, tricyantriamide, or their salts, reduce the temperature of the gases of combustion, without affecting the blasting power. Two examples of the explosives are as follow:—(1) Nitroglycerin, 60 parts; soluble nitrocellulose, 39 parts; and cyanamide, 1 part. (2) Nitroglycerin, 58 parts; insoluble guncotton, 37 parts; cyanamide, 5 parts. Accepted November 17, 1904.

86 (1904). **Shot Firing Batteries**. P. Kirkup, and W. Alderson, Birtley, R.S.O. A damp proof and easily portable shot firing battery for blasting, in which a hand operated contact breaker works in conjunction with a spark coil. The coil may be put into or out of circuit to obtain either a high or a low tension current. Accepted December 1, 1904.

751 (1904). **Cap for Projectiles**. W. W. Motteram, Ulverstone. A cap for armour piercing projectiles, which is made of some soft metal, and when in position leaves a space in front of the actual nose. To fix the cap a beading is formed upon the shell nose and the interior of the cap base is shaped to fit it. The cap forms a non-slipping cushion before the projectile point reaches the face of the object struck. Accepted November 17, 1904.

3,820 (1904). **Automatic Pistol Mechanism**. The Webley and Scott Revolver and Arms Co., Ld., and W. J. Whiting, Birmingham. An automatic pistol, constructed especially with regard to strength and simplicity. The mechanism works on the usual lines, and is enclosed entirely within the body of the pistol. Safety locking of the parts and the prevention of double unintentional firing are points particularly noticeable. Accepted December 1, 1904.

4,742* (1904). **Ammonium-nitrate Explosives**. The Miner's Safety Explosive Co., Ld., London, and W. Levett, Stanford-le-Hope.

7,157* (1904). **The Carter Single-Trigger Mechanism**. J. Carter, Sparkbrook.

7,818 (1904). **Quick-Firing Gun Cooling**. H. H. Lake, London (Agent for *Fried. Krupp, Ag. Grusonwerk, Germany*). A cooling device for quick-firing guns, consisting of a pump actuated by the movement of recoil. The compressed air from the pump is directed along the surface of the barrel through a number of jets, in such a manner that the outside air is also caused to help in the cooling operation. Accepted November 24, 1904.

14,106 (1904). **Rifle Rest**. T. Grünewald, Germany. A walking-stick is so built up that its bottom portion may be converted into a tripod having three legs. A rifle rest is attached to the handle of the stick. Accepted December 1, 1904.

20,104 (1904). **Loading of Ordnance**. C. P. E. Schneider, France. Combined with an ammunition cage is an articulated rammer consisting of a chain which is stiff in one direction but flexible in the other. A driving medium constantly rotating in the one direction operates to drive the chain rammer alternately in one or other direction. A drum beneath the carrier receives the chain. Accepted November 24, 1904.

21,204 (1904). **Gunpowder in Sheets**. La Soc. de la Poudre Peigne et des Brevets J. Luciani, Switzerland. A charge composed of a sheet of gunpowder coiled upon itself. Over the whole of the surface of the sheet, or over part only, cuts or notches of different shapes are formed. The depth of the cuts varies with the rate of combustion desired. A machine for rolling and notching the sheets is set out in patent No. 21,398, 1904, dealt with in another part of these digests. Accepted November 10, 1904.

21,398 (1904). **Manufacture of Gunpowder Sheets**. J. Luciani, France. An improved machine of the type described in specification No. 21,204, 1904, dealt with on this page, is set out in this patent. The machine is designed to manufacture sheets of gunpowder, and a wheel is attached on which are formed in relief the patterns of the incisions that it is desired to form in the sheets of explosive. Accepted Nov. 24, 1904.

21,435 (1904). **Ammunition-Hoisting Mechanism**. P. M. Justice, London (Agent for *The Bethlehem Steel Co., U.S.A.*) An ammunition hoist adapted to obviate risk of sparks getting into the handling room. Two elevators, one lifting the ammunition out of the handling room and the second taking it to the gun breach, are linked up by a transfer car. Accepted November 10, 1904.

21,487 (1904). **Rifle Sights**. Lt. F. Labiaux, Belgium. A sighting system in which the line of sight is constituted by the juxtaposition of two semi-circles—one carried beneath the bar of the back leaf sight, and the other by the top of the fore sight. This construction allows of an increase in the solidity of the sights, especially the front one, besides providing a better line. Accepted November 10, 1904.

23,031 (1904). **Fuse Head for Electric Blasting**. F. Render, Manchester. A fuse head for the attachment to the detonators of blasting cartridges, consisting of wood, vulcanite or papier mache. A hole possessing two or more diameters runs through its centre and herein is retained the insulating plug by sulphur or other cement. The plug carries the exposed ends of the wires, and these ends are held in the plug by a head or bead fused on to the tips after the ends have been passed through holes in the plug. Accepted November 24, 1904.

23,458 (1904). **Telescopic Ordnance Sighting**. Fried. Krupp, Ag., Germany. The type of sighting telescope by means of which distant objects may be sighted with the correct angle of elevation without relative adjustment to the barrel of the gun, is provided with an attachment to be used as an ordinary telescope, or for both fighting and practice charges. A second sighting mark is so arranged that when one mark is adjusted the other disappears from the field of view. Accepted December 1, 1904.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

A PROPELLANT EXPLOSIVE.

21,482 (1903). F. E. W. Bowen, London. A propellant consisting of a mixture of nitrocellulose in the gelatinous condition and ammonium perchlorate is set out in this specification. The nitrocellulose is dissolved in suitable solvents, such as acetone or alcohol-ether, and when thoroughly gelatinised, it is incorporated with ammonium perchlorate thoroughly pulverised. A small percentage of vaseline, clarified jelly, aniline, or suitable hydrocarbon may be added as a retarder and lubricant.

The materials are thoroughly mixed. Before the evaporation of the solvents, and while still plastic, the mixture may be rolled, pressed into sheets, cords or other desired forms, and when dry cut up into discs, tablets or cylinders, or may be granulated. Good results are obtained with 25 to 33 per cent. of ammonium perchlorate, and from 66 to 75 per cent. of gelatinised nitrocellulose. The temperature of combustion may be lowered by the addition of a small percentage of ammonium oxalate. To raise the temperature carbon may be added, but when a very high temperature is desired aluminium is combined in the explosive. It is claimed that most of the defects of nitroglycerin explosives are avoided, and that the explosive set out is entirely gaseous, is staple, and possesses ballistics of a high order. Accepted November 5, 1904.

A PERCHLORATE OF AMMONIA EXPLOSIVE.

21,481 (1903). F. E. W. Bowen, London. In order to produce a high explosive possessing high potential energy and qualities of stability and safety, three different elements are combined. First, a combustible body which on decomposition will give rise to a large volume of gases; second, a supporter of combustion or oxygen carrier; and third, a material which on combustion sets free a very large amount of heat even though no gases be formed by its combustion.

As to the first element such substances as carbon, hydrocarbons, carbo-hydrates, or organic nitro-compounds are used, the last-named particularly if it is desired to produce a blasting explosive. As to the second element perchlorate of ammonia is employed, this substance being rich in oxygen, very slightly soluble, and non-hygroscopic, whilst its components are all gases. As to the third element the metals aluminium, magnesium or mixtures of these are used. Although solids are produced on combustion, the caloric value is so great that the gases produced by the other two elements

are expanded greatly. A combustion of these three elements in the following proportions has been discovered to produce a safe and powerful explosive for shells. Perchlorate of ammonia, 75 per cent.; aluminium, 12 per cent.; and paraffin, 13 per cent.

By the Tranzl test this explosive gave 525 cubic centimetres against 360 cubic centimetres of a like charge of dynamite containing 75 per cent. nitroglycerin. One kilogramme of the explosive gives rise to 868 litres of gas.

An explosive sensitive enough for mining works, is as follows:—Perchlorate of ammonia, 72 per cent.; aluminium, 11 per cent.; nitronaphthalene, 17 per cent. This mixture gives 460 cubic centimetres in the test, and one kilogramme gives rise to 726 litres of gas. The proportions may be varied to accord with different results it is desired to obtain, but the carbon should be present in such quantities as to combine, in conjunction with the aluminium, with the oxygen present, or with the major portion of it, the product CO_2 being mainly formed. Accepted November 5, 1904.

A NITRATE OF AMMONIA EXPLOSIVE.

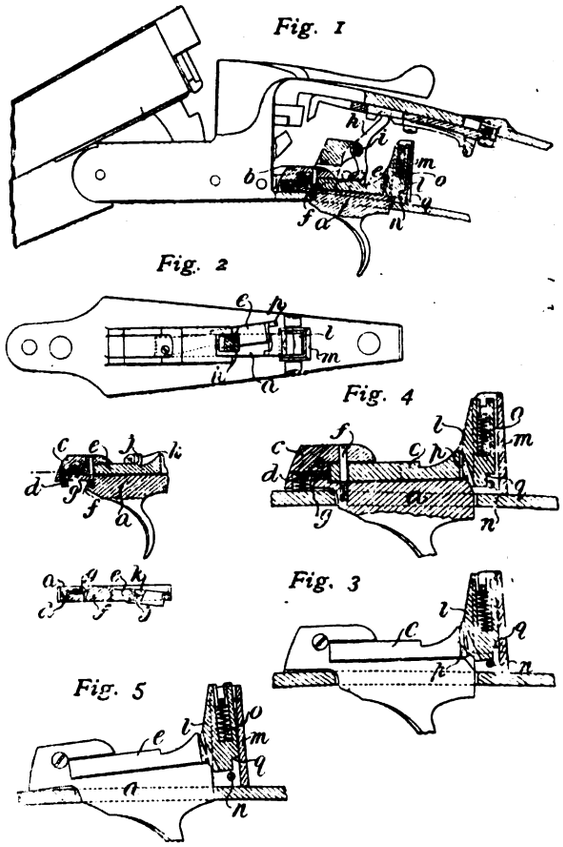
4,742 (1904). The Miner's Safety Explosive Co., Ld., London and W. Levett, Stanford-le-Hope. In explosives of the ammonium nitrate type, sodium nitrate is substituted for some of the principal component in order to reduce the cost of production. A first mixture is prepared by grinding nitrate of ammonia for 45 minutes at a temperature of 180 deg. Far. Trinitronaphthalene is added and the grinding is continued for a further 30 minutes at the same temperature. The proportion of each is 95½ per cent. of nitrate of ammonia, and 4½ per cent. of trinitronaphthalene. A second mixture is prepared by grinding 80 per cent. of sodium nitrate and adding 20 per cent. dinitronaphthalene in the same way as the first mixture. When these two mixtures are cold they are broken up in an edge-runner mill, sifted through a sifting machine and brought together in a mixing machine in the proportion of 33 per cent. of No. 1 to 67 per cent. No. 2, or 50 per cent. of each, or 67 per cent. No. 1 to 33 per cent. of No. 2. The first of these mixtures produces a fine free powder, while the second produces a cohesive powder which tends to form grains. When 33 per cent. of the first mixture is added to 67 per cent. of the second the following is substantially the formula of the explosive. Trinitronaphthalene ($C_{10}H_5 3 NO_2$), 1½ parts; dinitronaphthalene ($C_{10}H_6 2 NO_2$), 13½ parts; ammonium nitrate ($NH_4 NO_3$), 31½ parts; and sodium nitrate ($Na NO_3$), 53½ parts. It is claimed that this explosive, which may be conveniently packed into cartridges of the type described in Patent No. 11,675, of 1902, has less shattering effect than that in which only nitronaphthalene and nitrate of ammonia are used. Accepted November 24, 1904.

THE CARTER SINGLE-TRIGGER MECHANISM.

7,157 (1904). J. Carter, Sparkbrook, nr. Birmingham. The single-trigger mechanism described in this patent depends upon the involuntary pull to shift an intercepting block and so to allow the laterally swinging sear lifting arm to take its place ready for the discharge of the second barrel.

The system is illustrated in the drawings which are printed on this page. The single-trigger *a* is pivoted, as is usual, in the lump *b*. Between the trigger plate and the extension *c* of the blade is the spring *d*. This is adapted to return the trigger to its normal position after it has been lifted. The sear-lifting arm *e* works above the trigger blade and it turns upon the pivot *f* running vertically through the blade. A second spiral spring *g* presses against one side of the end of the arm *e* in such a manner as always to tend to force the rear end of the arm over towards the left-hand lock. The position of this spring in relation with the other parts is clearly set out in the detailed illustrations not numbered. The general arrangement of the parts is shown in Figs. 1 and 2. From Fig. 1 it will be seen that a lever *h* is pivoted at *i* on an extension of the lump. The top of this lever works in a slot in the bar operated by the safety slide. When the safety slide is moved the lever *h* is turned on its pivot, and its lower end is caused to slide over the inclined surface *j* of the projection *k* on the arm *e* and so to force the arm over to a position beneath the right-hand sear. In this position the arm is held by the pressure of the sear tail which is forced down on to the arm by its cocked tumbler.

When in this position (Fig. 2) the first pull upon the trigger lifts the right-hand sear and discharges the corresponding barrel. The



recoil following the discharge jars the vertically mounted "interceptor" *l* from its normal position, clearly shown in Fig. 3, to that set out in Fig. 4. The part *l* is loosely mounted on the post *m*, and is held in the ordinary position by the projection *n*. When jarred off this projection, the spring *o* forces it down into the path of the outstanding part *p* on the end of the sear-lifting arm *e*. Thus immediately after the first discharge the arm is released, but in its lateral travel, influenced by the spring *g*, it is brought up by the interceptor *l*, which is jarred by the recoil into its path. The interceptor is momentarily locked in this position by the engagement of the recess *q* with the projection *n*. The recoil is followed by an involuntary pull. This pull is caused to remove the interceptor and to allow the arm *e* to resume its travel and to take up its position beneath the left-hand sear ready for the second discharge. The involuntary pull brings the inclined part on the back of trigger blade into engagement with the inclined part on the bottom of the limb *l* (Fig. 5). Against the pressure of the spring *o* the part *l* is lifted up and is forced back into its normal position (illustrated in Fig. 3). Accepted November 24, 1904.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

The Sale of Air Guns.—A certain amount of bad feeling seems to have been caused in Birmingham by the sale of air-guns which are not everything that is represented. It appears that certain local firms anxious to benefit by the large demand for air-guns that has grown up of late years are in the habit of purchasing common types of these guns from the Continent, and selling them as their own make after a few minor alterations have been effected. It is well known that the continental pattern of air-gun is one of the worst samples of garret output. To replace brass springs by others made of steel, to change ill-made pivot pins for steel wire true in dimensions, and to remedy the prevalent complaint of chronic headache in the joint pin, is hardly sufficient to change the makership of a gun or anything else. American rifles when fitted with Lyman sights do not thereby become English, even if they bear a gunmaker's name and are put up in a canvas-covered case with an assortment of cleaning appliances. So much of the usefulness of an air-gun or rifle depends upon the perfect adjustment of the sights that the retailer honestly earns a substantial profit if he conscientiously performs this operation. The public will not, as a general rule, pay an enhanced price for a weapon of standard pattern which has been adjusted and regulated by a practical gunsmith. The obvious remedy for this parsimony is to conceal the true origin of the weapon, and so create for it a separate reputation based upon the care which has been bestowed upon it since its delivery in bulk. So long as two rifles or air-guns of precisely identical make may shoot well or badly according to the skill that is lavished on their final adjustment, the retailer will be able to justify the profits he earns. The manufacturer can never pay much attention to these trifles, but it is open to every retailer to educate his clientele into appreciation of the work he does on all that passes through his hands.

Miniature Rifle Meetings.—The announcement that the National Rifle Association will hold this year's miniature Bisley meeting at Exeter implies that the joint arrangement with the Society of Miniature Rifle Clubs will not be renewed. From many points of view this decision is to be applauded. The development of miniature club shooting must proceed on the lines of using a proper miniature rifle and not an emasculated service weapon which in its adapted form represents an inferior makeshift. Whether the smaller society will be able to go ahead on the tolerant lines of admitting any type of rifle will rest with those who hold the purse-strings of benevolence. At any rate, immediate danger of the large association swallowing the small society is passed, and we must all sincerely trust that the hands of General Luard's society will not be tied for want of funds, Clubs will rally round the society that recognises the principle of home rule within reasonable bounds for rifle clubs. The civilian shooter is a man who is doggedly determined that his rifle practice shall be conducted with an arm that puts the bullets where the sights are aligned. Six-inch diagrams at 25 yards are all very well for the Volunteer recruit practising in his drill hall; but the rifle clubman manages his affairs better than those who rule the destinies of Volunteer detachments. Consequently, in his endeavours to materialise sound conditions of shooting he is not long in finding out that a good miniature rifle chambered for ammunition costing from one to two shillings

per hundred rounds can give points to the equipment which the N.R.A. seems so unduly to favour. When we have a military service rifle soundly sighted and adapted by tubes or the fitting of special barrels to fire rim ammunition as well as an ordinary rifle it will be time enough to consider which weapon our clubs ought to use. At present, the miniature rifle holds the field for miniature distances, notwithstanding Mr. Astor's financial inducement to use the service weapon, and it is the Society of Miniature Rifle Clubs that caters for the sensible method of practice.

The Technical Education of Officers.—Among the facts that strike the outside critic of military methods in small-arms and ordnance design and construction is that scientific knowledge is confined to the very few. Among the younger and more progressive officers, there is a constant chafing against the restrictions that hamper their legitimate advancement. The engineer or chemist who seeks to enlarge his professional scope finds but little difficulty in opening up most valuable channels of information. In the matter of war material, on the other hand, the very facts and deductions that would bring the beginner into touch with the work of his more skilful contemporaries is locked up in the form of half-digested conclusions and reports which are filed away in some inaccessible place. Progress can never be active without constant interchange of views and experiences. But this is the very thing that present methods discourage. Those officers who are allowed to make public some research of minor importance show only too clearly that their information is not of the best. This is because those having access to official information are barred from publishing anything that in any way bears upon what they may have learnt at the Government expense. The official handbooks are carefully limited in extent so as to contain only those things which have been discovered by outsiders. Most of them accordingly suffer from want of balance through the absence of information material to the subject matter discussed. We have shown on a former occasion that the secrecy which surrounds these matters is easily pierced by the representatives of foreign nations who are in need of a given item of information. The present policy accordingly hampers that exchange and co-ordination of individual experiences which enable the author to piece together a connected statement of any given subject. The brilliant officers we have in the Government manufacturing departments indicate that abundant raw material exists which would develop with reasonable opportunities for advancement.

A Journalistic Curiosity.—A writer in the *Morning Post* of the 21st ult. contributes a most weird article concerning the resistance of war-ships to torpedo attack. Having arrived at one hundred and seventy-four thousand foot-tons as the explosive equivalent of a Whitehead torpedo, the writer sets to work to show us how to meet the blow of the torpedo by an equal resistance on the part of the sides of the vessel. His idea seems to be so to construct the sides of the ship as to leave a closed space which may be inflated with air in the manner of a bicycle tyre. By treating tons per square inch pressure as interchangeable with foot-tons of energy he shows that so far from the torpedo having any effect on the battleship, the greater force shall expel the lesser force, and thereby presumably return the torpedo in the manner of a postal communication refused by the addressee. Newton's second and third laws of motion are directly applied to the construction of battle-ships. It is impossible for us to follow the writer in all his arguments, but so far as we can understand them it appears that the torpedo may blow a hole in the side of a vessel, but so soon as this hole is made the compressed air rushes out, and by balancing the force of the explosive gases, it deprives them of further power to do injury. Notwithstanding Newton's laws of motion and the analogy provided by a punctured bicycle tyre, we cannot help thinking that there must be a screw loose somewhere. In the various little experiments with explosives which we have witnessed there never seemed to be time for the more obvious laws of force and resistance to come into action. Whether it is a case of the tallow candle being blown through the door, or a matter of the theoretical elasticity of the resisting medium, the explosive effect seem to be the only certain outcome of the experiment. The ship has yet to be made which will have a strength of hull equal at every part to the explosive force of a gun-cotton war head. If we worked out the thickness of armour-plating that would comply with this requirement we should be able to form a relative idea of the pressure necessary for a protective air cushion. We hardly think that the writer's seven hundred and fifty pounds to the square inch would satisfy the needs of the case.

Gun-cotton for Torpedoes.—While we have every admiration for the many-sided gifts of Mr. L. Marten Hale, gun-cotton manager of the National Explosives Company, we cannot quite follow the arguments which he has employed in an article addressed to one of our engineering contemporaries. He seeks to explain the disappointing results obtained from the Whitehead torpedo in the present war by the fact that the gun-cotton charge is made up in slabs and discs, as distinguished from an alternative method of construction in which Mr. Hale is personally interested. The argument he uses against the sectional method of building up the torpedo war head is that the full force of the explosive is impaired by these interruptions in the continuity of its substance. He also infers that the thin copper case which contains the explosive does not possess sufficient confining power to bring forth the full pressure of the gas. He moreover holds the view that the explosion of the entire mass of gun-cotton is inadequately effected by the placing of the detonator and igniting primer at the pointed nose of the charge. These views are so absolutely inconsistent with everything that is known concerning the action of explosives that we will not assume on the part of our expert readers that they could gain anything from what we might say on the subject. The method of building up torpedo charges in a solid lump has many features of practical convenience. But it is a mistake in business tactics to assume disadvantages in the alternative method which do not exist. It seems from the letter before us that three foreign governments have recognised the many advantages of the new method of making up torpedo charges. But we should be very surprised to hear that the arguments used by Mr. Hale would have any weight in influencing the decision of other governments that have not yet come into line. The conception of water as a buffer or cushion that diminishes the effect of a gun-cotton charge appears to assume an elasticity in this medium with which it is not usually credited. However good a thing may be, it is bad policy to uphold it by unsound reasoning.

THE SMALL ARMS COMMITTEE.

THE most tangible product of the Small Arms Committee, the new short Lee-Enfield rifle, continues to form the subject of public discussion. Production of the new rifle proceeds apace, and the general state of feeling is that a blunder has been perpetrated. As the best informed journals appear to be in a state of uncertainty as to the personality of the Committee, we append the following statement of its members as taken from the last issue of the Army List:—

President:—The Commandant, School of Musketry, Hythe.
Ex-Officio Members:—The Superintendent, Royal Small Arms Factory, Enfield; The Chief Inspector of Small Arms; The Chief Inspector, Woolwich; The Superintendent, Royal Laboratory; The Staff Captain (for Musketry), Aldershot.
Naval Member:—Lieut.-Col. L. T. Pease, R. M. Art., *p.a.c.*
Civil Member:—Mr. A. P. Humphry.
Associate Member:—Col. J. R. P. Gordon, C.B.
Secretary:—Deputy-Assistant Director of Artillery.

It will be seen that not a single member of the Committee has been chosen on account of any special fitness for dealing with intricate small arms problems. Its members are, moreover, men, the first call upon whose time is made by a post that is filled elsewhere. By giving the names of the present holders of the positions, which qualify for membership of the Committee, we shall see in what instances good men have been brought into the right place by accident. We accordingly repeat the list in this form:—

Col. C. C. Monro (President), Hythe.
Bt.-Col. H. S. S. Watkin, C.B., Enfield.
Lt.-Col. J. D. Hopton, Chief Inspector of Small Arms.
Lt.-Col. F. F. Minchin, *p.a.c.*, Chief Inspector, Woolwich.
Major Sir H. W. W. Barlow, Bart, R.A., *p.a.c.*, Woolwich.
Capt. P. Balfour, Aldershot.
Lt.-Col. L. T. Pease, Naval Member.
M. A. P. Humphry, representing N.R.A.
Col. J. R. P. Gordon, representing the Cavalry.
Major M. H. Egan, *p.a.c.*, Secretary.

We might be doing a serious injustice to some of the gentlemen above named if we attempted to pass judgment upon them individually concerning the character of their qualifications for membership of the Small Arms Committee. Because Col. Hopton is the only member of the body who has really acquired a reputation for knowing his subject, it is usual to think of him as especially responsible for its decisions. We are amongst those who have fallen into the error of thinking he was President of the Committee. He is but an ordinary member, having automatically vacated the direction of its policy in October, 1900, when he was transferred from the chiefship of the School of Musketry to his present office. This was before the question of a short rifle had been mooted. We know, again, of Mr. Humphry as a valued member of the N.R.A. Council, but we never heard of him taking any special interest in the more scientific and mechanical aspects of small arms. Sir H. W. W. Barlow contributed the article on military small arms to the new volumes of the "Encyclopedia Britannica." Still, speaking of the Committee as a whole, we can only select Col. Hopton as one who has the experience and natural taste for the subject that such as would qualify him for membership apart from official position. Past discussions concerning the chiefs of our more important War Office establishments show us that technical knowledge is mostly possessed by the permanent staff, and that a superintendent may never have seen the thing he superintends till he takes over the duties of a strange position. Much of the work of a committee depends upon the breadth of view and the patient work of the secretary, and it is only fair to say of Major Egan that in him we have emphatically the right man.

If we turn to the personality of the other committees, we shall find precedents that might with advantage be introduced into the organisation of the Small Arms Committee. Sir Andrew Noble, who, though stained by association with a money-making concern, is a member of the Explosives Committee by reason of his acknowledged sterling merits. Sir William Crooks gives the same committee a further claim to speak with knowledge and authority. In fact, the Explosives Committee seems to have been chosen with a view to the performance of sound work. It has a chemical research department, and it can accordingly speak from first-hand knowledge concerning debatable points upon which light can only be thrown by special investigations. The Ordnance Committee has Dr. Kellner and Dr. Dupré as Associate Members, together with many others whose scientific and engineering knowledge is beyond cavil. We should be willing to lay odds against more than three of the members of the Small Arms Committee being able to work out a trajectory table for a new rifle bullet, given the usual particulars. Yet, when we turn to the membership of the Ordnance Committee, we find that it contains the name of Prof. Greenhill as mathematical referee. Concerning the professor's qualifications it is sufficient to say that he combined the highest mathematical attainments with a fine appreciation of practical issues.

In summarising the attributes of the Small Arms Committee, we thus find that instead of being composed of men of undoubted ability and specialisation, it is nothing more or less than a chance assembly of office holders. We do not want a committee of Queen's prizemen, nor of academic persons pure and simple. All we ask is that the various sections of small arms science shall be duly represented in its personality. There is the shooting and marksmanship aspect of the subject. There is the armourer and repair-shop side of the question. There is the mechanical engineering point of view of the manufacturer. Active service experience of small arms is most important. Optical considerations again must not be ignored. Applied mathematics of a very practical kind must also be represented. And, finally, there is the shooting ground and laboratory, without which no real progress can be made. It is not sufficient that Hythe should be asked to do this, and that such and such a shop foreman should be consulted as to whether it would cost a great deal to make a certain change. The Committee should be in a position to act upon its own information. Properly equipped with brains and suitable experimental facilities, it could set to work without delay to set right many things that are glaringly out of date in the design of our small arms and ammunition. So long, however, as the Committee retains its present constitution, and changes its president three times in every five years, it will continue to act without purpose and without a proper sense of responsibility.

THE RECOIL OF SMALL ARMS.

THE *Royal Engineers' Journal* was started in 1870 as a monthly newspaper for private circulation amongst subscribers. Various changes have since taken place and the latest is embodied in the decision of the committee of the Institute to issue the journal as a magazine available for purchase by the public. Volume I., No. 1 of the new series leads off with an article by Lieut. F. V. Thompson, R.E., concerning the recoil of small arms. In a prefatory note by Major C. F. Close, C.M.G., R.E., we are told that, following the publication of Crehore and Squire's experiments in photographing the recoil of small arms, he carried out a series of researches on similar lines. It seems that an account of these experiments was published in 1897 as part of the confidential series of professional papers of the corps of Royal Engineers. The policy of observing privacy in such a matter has doubtless deprived us of instructive information, and has withheld a useful stimulus towards similar researches in the same line. Major Close admits his indebtedness to Crehore and Squire, but the limited publication of his own conclusions has left others without the inducement that carried him forward. We may, therefore, welcome the new *régime* which has allowed Lieut. Thompson's work to see the light of day. The cause of science will gain by such researches, and he himself may gain fresh wisdom from criticism due to independent examination of his results.

The shooting department of our contemporary, the *Field* has conducted a large number of experiments concerning recoil during the past few years. These, added to the information previously published by Mr. Griffith, give us every right to speak with the authority of sound information. In the experiments of which we have cognisance two forms of recoil investigation were conducted. In the first a gun was suspended by two wires in such a way as to allow it complete freedom of backward motion. When the rifle had moved back a suitable distance so as to build up its full velocity of recoil an electrical contact was operated and a register made on an ordinary chronograph. After completing a further distance of travel a second contact was broken and the chronograph gave the time of the gun's passage from point to point. By applying a suitable correction for the weight of the added fittings and for the lift of the gun on the arc of its recoil an absolute value was obtained. Another method of recent recoil examination is associated with the name of Mr. Borland, who made photographic registrations of the movement of tiny points of light emerging from electric lamps attached to the barrel. These two methods have given us a considerable amount of scientific data which are of great importance in recoil investigation. Lieut. Thompson strikes out a new line with an apparatus which shows time as well as direction of movement. He solders on to the barrel of the weapon under examination a series of highly polished silvered balls. These reflect from whatever position they are viewed a tiny glint of light from an arc lamp which is set burning conveniently near. The continuous illumination of the arc lamp is converted into a series of momentary flashes by the rotation of a perforated disc, so indicating a series of time intervals. In this way the photographic curve of recoil becomes a dotted line, the distance between the interruptions showing the rate of travel of the gun over the different sections of its path.

Judging by the photographs which are published it would appear that this affords but a very approximate means of taking velocity. There seem to be only about three flashes for every inch of movement by the gun. However carefully these may be measured by means of a micrometer, and however scrupulously the rate of rotation of the motor-driven disc may be observed, the fact remains that as a means of measuring time intervals it is out of date by comparison with an ordinary chronograph. When we further remember that the light passes through a photographic lens it is clear that if the rifle recoils in any other plane than that absolutely at right angles to the axis of the lens, serious distortions must arise. In view, therefore, of the *Field's* experiments on the more exact basis of chronographic measurements we may dismiss Lieut. Thompson's apparatus as an inappropriate and inefficient method of taking the maximum volocity of recoil of a freely suspended rifle. From his paper we should be inclined to doubt whether he has really obtained much mathematical information from the analysis of his recoil records. We have shown that his measurement of recoil velocity is by no means carried out on the best principles, and we can see in no part of his paper any attempt to gain other forms of time reading from his interrupted tracks of light.

The most important piece of information that can be obtained from a velocity measurement of recoil is the rate of efflux of the gases from the muzzle of the barrel. The well known law of motion to the effect that action and reaction are equal and opposite enables us to calculate from the velocity of the bullet the momentum of recoil at the moment when the bullet leaves the muzzle of the barrel. The difference between this momentum and that derived from the maximum measured recoil is the momentum due to the emergence of the gases fram the barrel after the departure of the bullet. By dividing this momentum by the weight of the rifle we obtain the average velocity of efflux of the gases. This, Lieut. Thompson fixes as 4,300 feet per second. In our lecture to young gunmakers on the recoil of cordite express rifles which appeared in August last year we fixed the amount at 2,900 feet per second. Considering that the two experiments should have given the same result, we are surprised that Lieut. Thompson has not taken more trouble to investigate possible explanations of the difference encountered. He assumes, which is a wrong thing to do in the case of a quantity which is susceptible to measurement, that the velocity of the bullet is 2,000 feet per second. This, as a matter of fact, is the mean velocity over 180 feet, and if he had turned to Table IV. of the *Text Book of Small Arms* he would have found that the muzzle velocity of the new short rifle is 2,060 feet per second. It is, of course, impossible to say what was the exact velocity of the rifle and ammunition he used in his experiments, but failing tests he should have adopted the official value.

He takes the weight of the short rifle at 8·5 lbs. when the official weight is 8 lbs. 2½ oz., say 8·16 in decimals. With an assumed velocity of 2,000 feet per second, and 8·5 lbs. weight of rifle he obtains 7·72 feet per second for the calculated velocity of recoil at the instant the bullet leaves the muzzle. By his system of measurement he obtains 9·98 feet per second as the maximum velocity of recoil. A little arithmetic then

gives 4,300 feet per second as the velocity of gas efflux. Had he taken the official figures both for the muzzle velocity of his bullet and for the weight of the rifle he would have obtained 3,040 feet per second as the rate of efflux. If for some reason, which he does not explain, his rifle really weighed the 8·5 lbs. stated, the velocity of efflux would have become 3,802 feet per second. If the first calculation truly represents the conditions of the experiment we have a very close confirmation of the *Field* results, but if his rifle was for some reason above the ordinary weight we must assume the existence of an error, of which the explanation is not obvious. We must in any case receive the velocity 4,300 feet per second with doubt and suspicion, and we incline to the belief that Lieut. Thompson's conclusions are wrong to the extent that they differ from ours.

In our lecture published last August we gave a series of recoil velocities from a number of different rifles. These were taken by the much more exact method of chronographic measurement, and the velocity of the bullet was ascertained for each rifle and batch of ammunition before the recoil test was made. Amongst the actual experiments quoted was the measurement of recoil velocity of the new short rifle. All

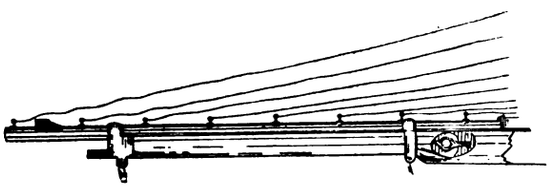

FIG. 1.—RECOIL MOVEMENT OF LONG SERVICE RIFLE.

measurements were made with the most scrupulous accuracy, and we should certainly prefer our own figures to those of Lieut. Thompson. A full report of a similar series of experiments was delivered to the Small Arms Committee and they were accepted as correctly showing the true state of affairs. Our reason for objecting so strongly to Lieut. Thompson's strange method of measuring recoil velocity, and to the use by him of doubtful data is that he has been led to publish in the journal of an important institute an erroneous figure for gas efflux. The experiments quoted in our last August issue gave the following rates of efflux for five types of rifle, firing cordite ammunition, viz., 2,900, 2,989, 3,275, 2,920, and 3,260 feet per second respectively. We showed that by adopting 3,000 feet per second as the characteristic rate of efflux of cordite gases we could supply the missing value in the formula for calculating the recoil of rifles which would be true to three per cent. of the total energy even in the presence of the extreme variations which are shown in the above series of results. It was indeed a very important advance in rifle ballistics to be able, from the known data of weight of rifle, and velocity and weight of charge, to ascertain the energy of recoil within a margin of error so small that it does not influence the first place of decimals. If Lieut. Thompson's 4,300 feet per second is correct our assumption fails, but we think we have said enough to indicate that from the point of view of velocity measurements, his investigations, great as is their value in other directions, have not been carried out with sufficient attention to detail to justify us in treating them as seriously questioning earlier work carried out on a more exact basis.

While we object to the photographic method of measuring recoil velocity which has been adopted by Lieut. Thompson, we think that his photographic representations of the movement of recoil give much valuable information. He records by his apparatus in the most perfect manner, the movement of every single portion of the rifle barrel to which one of his "collar stud" fittings is attached. We have taken the liberty

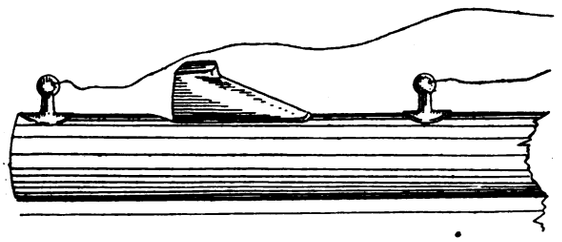

FIG. 2.—MUZZLE MOVEMENT OF LONG RIFLE.

of reproducing the accompanying diagrams which illustrate the movement of the barrel at various recording points. His diagrams show that the individual studs do not follow the mean curve described by the barrel as a whole, the ripples which they display being nothing more or less than the vibrations of the barrel in the action of the firing. It seems from an examination of photographs taken on a larger scale that there are two sets of vibrations on the Lee-Enfield full length rifle. The vibratory movement of the barrel which takes place at the moment when the bullet leaves the muzzle obviously affects the shooting. The fact that the fourth stud in the first diagram represents nearly a true curve affords evidence that the vibrations are neutral at this point. We similarly produce a third diagram which shows the muzzle movement of the new short rifle. We must, however, refer our readers to the text of Lieut. Thompson's paper for a ull analysis of the interesting observations which are there recorded.*

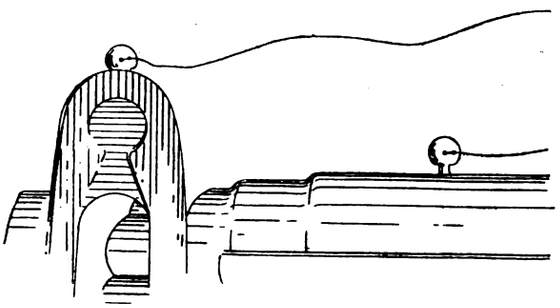

FIG. 3.—MUZZLE MOVEMENT OF SHORT RIFLE.

It will be seen from our review of these experiments that, while we attach very great importance to the care and skill which have been shown in the examination of recoil movement, we adopt a more critical attitude with regard to the attempt to obtain reliable time measurements by the method of light interruption which forms the basis of the first portion of the paper.

* The publication can be purchased for the price of one shilling, postage extra, from the Secretary of the Royal Engineers Institute at Chatham.

THE N.R.A. REPORT.

THE report of the National Rifle Association for the year 1904 contains the usual record of important work consistently performed for a public object. The carrying forward of a surplus of £991 is effected after including in the Revenue Account certain items which can hardly be regarded as ordinary expenditure. The interest which national rifle shooting possesses for the gun and its allied industries is never very great. The N.R.A. was started originally as a means of giving permanence to Volunteer corps, the encouragement of rifle shooting being the second consideration. While it now devotes its entire attention to rifle and revolver shooting, its whole policy is directed towards a military end. So far is this policy carried that it almost amounts to a prejudice against anything that has not a directly military aim.

While the policy of advancing strictly military shooting is quite consistent in respect to contests for Volunteers, it is not sufficiently elastic to meet the needs of civilian rifle clubs. In order that our working classes and clerical population shall take up rifle shooting as an interesting hobby for the occupation of leisure hours, its pursuit should be as little fettered as possible with hard and fast regulations insisting upon the use of inappropriate military weapons. All we ask on behalf of rifle clubs is that the regulations that govern them shall be marked by the same spirit of toleration that is shown towards the match rifle enthusiasts at Bisley, whose ranks are largely recruited from members of the N.R.A. Council itself. The fact that the National Rifle Association does not recognise miniature rifles of a non-service type is strangely inconsistent with the policy adopted towards Miniature Clubs. The non-service rifle is rigidly tabooed. Under this policy of suppression the civilian clubs are becoming restless, and it is really a pity that the master minds of the Council still refuse to recognise the miniature weapon as specially designed for miniature shooting as at least the equal of the Lee-Enfield and the Martini-Enfield rifles which are issued to rifle clubs. Considering that the civilian rifle club element now represents some 555 clubs, with a total membership of 34,654 members, it is strange that the Council has not made arrangements for a single representative of civilian clubs amongst its members. Now that the N.R.A. have lost the services of Mr. Arthur S. Bates, as organising secretary of rifle clubs, it would be a graceful and practical movement on their part to reserve for him the earliest available vacancy in their Council. Both as a practical exponent of shooting, and as a man of good social position, he should prove an excellent representative of an interest which is not sufficiently recognised at the present time.

Concerning the more technical aspects of the year's record of rifle shooting, there is little or nothing to add to the remarks which appeared in these columns following the Bisley Meeting. The continued success of the Palma cartridge, the absence of opportunity to test the new short rifle, and the growing preponderance of English-made rifles in contests open to weapons of miscellaneous origin—all received their due share of attention when the news was fresh. The advertisement value of a Bisley contest offers a strong inducement to the manufacturer to make the best show possible, and as the conditions were equally fair to all, we can congratulate ourselves on the successful efforts of our own manufacturers.

THE PROOF OF FOREIGN GUNS.

ALTHOUGH various interested parties were successful in defeating the wish of the two Proof authorities to apply a differential marking to weapons of foreign origin, the pinch of competition daily shows how advantageous such a step would have been. While Birmingham gunmakers deplore the absence of orders, they find that every dealer's stock contains samples of weapons which have been entirely made abroad bearing the English proof mark and other indications of British origin. It may be an offence against the Merchandise Marks Act to expose for sale a gun bearing an English name which is wholly or substantially of foreign origin. Then, again, as our Proof Houses are managed by gunmakers, there must be a large body of evidence going to show most conclusively that Belgian guns are sent to this country for proof, being afterwards returned to the Continent to be finished and marked in a manner over which we can exercise no control. The Belgian guns which go to British Colonies bearing false indications of British origin, go to show that Colonial sentiment favours the English gun in preference to its continental rival. All these years, during which Belgians have been sending to our Colonial markets guns which are ostensibly made by ourselves, a species of goodwill has been built up, which we may turn to our own advantage when once we have settled private disputes.

If the Proof Houses could be assured of the joint support of the workmen as well as of the masters, they might be induced to take up afresh the question of accompanying the proof-marking of foreign weapons with an indelible stamp indicative of foreign workmanship. Now that the paid agitators of the gun trade have at last been convinced that they are numerically of too small a political importance to influence the decisions of our Government departments, they may be willing to consider in a more friendly spirit of toleration a reasonable instalment of reform for existing abuses. They should be capable of appreciating the importance of accepting an instalment rather than losing the whole through wanting everything their own way. Now that the Proof Houses have achieved the whole of the amendments of technical procedure, which were necessary to their continued efficiency, the workmen then cannot hold over them the threat of obstruction and delay if their demands are not fully granted. The passage of a modified system of dealing with foreign arms is so readily accomplished when once differences of view have been smoothed over, that there should be no hesitation in attempting a definition of a mutually beneficial policy.

There need be no delay while experiments are proceeding, because there are none to make. All that is necessary is to arrive at a line of demarcation which shall separate for proof purposes the weapons which may respectively be considered as qualifying for the English and the foreign proof mark. The more flagrant methods of deception would at once come within the scope of a proper defining regulation. The half-and-half instances, where deception is practised, might to some people seem too drastically penalised, while to others the rules adopted might appear insufficiently prohibitive. Practical experience would, however, provide excellent opportunities for determining the scope of future amendments. In this way we should gradually take possession of the foreign markets which the Belgians now retain in our name.

ROUND THE TRADE.

THE annual dinner of the Middlesex Gun Club will take place on Thursday the 16th inst., at the Monico Restaurant.

Notice of bankruptcy has been made in connection with the affairs of Mr. H. F. Anderson, gunsmith, of Bedale, Yorks.

We understand that the Council of the National Rifle Association has arranged to postpone indefinitely the scheme mooted last July for issuing an official journal.

We understand that the Clermont Explosives Company have decided to abandon the carrying on of their London branch at Winchmore Hill, and that Mr. Martin Pulvermann has been appointed their selling agent.

Mr. William Macnab, F.I.C., whose name is so well known as an advisor on technical explosives questions has sent us an intimation that he has left Howick Place, Victoria Street, having moved to 10, Cromwell Crescent, for which Earl's Court is the nearest station.

Concerning the questions that have arisen as to the use of wind-gauge sights at the Bisley Meeting, as fitted to the new rifle, the N.R.A. have decided that no sights are to be eligible for volunteer competitions which are not fitted to the weapons issued to this section of the army.

Mr. Arthur E. B. Wilkinson has written to us in the capacity of director of Charles Osborne & Co., Ld., to the effect that our statement concerning the revised price for U. M. C. cartridges was not quite accurate, the present position apparently being that smokeless short ·225 are the same price as black.

The agents for Cooppal smokeless powder have asked us to make a slight correction in a note which appeared in these columns last month. It is to the effect that while they did quote in their last pamphlet a series of tests in which the pressure of their powder was stated at an absurdly low value, they do not now claim this feature for their powder.

One of the most amusing aspects of a paper entitled the *Bullseye* is that it announces itself on the front cover to be the official organ of the National Rifle Association, whereas the editorial articles are mostly written in a very critical and unfriendly spirit towards this august body. There is, however, a distinct improvement in this respect in the January number.

The civilian aspect of rifle clubs is amusingly maintained in a large number of instances by the practice of well-known volunteer shots ranking as "Mr." on such occasions. We should prefer the military rank to be indicated in every class of rifle-shooting contest, thus showing the civilian members the leeway they must make up in order to gain a footing of equality.

Major-General D. D. T. O'Callaghan, C.V.O., who has recently relinquished the command of the Royal Artillery at Malta, has been appointed President of the Ordnance Committee in succession to General Owen, who vacates it on completion of his three years' tenure. General O'Callaghan was formerly secretary of the committee, and later on a member.

The report and balance sheet of Messrs. Eley Bros., Ld., shows that the directors have decided to recommend a dividend at the rate of five per cent. per annum for the past year. In commenting on the decline of profit which is so shown they point out that serious disorganisation of the business was involved in transferring the manufacturing operations to the new building at Angel Road.

The N.R.A. report on the miniature rifle meeting states that the Society of Miniature Rifle Clubs accepted an invitation to join in the meeting, and held a number of competitions at the same time. This appears to us rather an ungenerous way of referring to the society which initiated the idea of a miniature Bisley and carried out a highly successful meeting before the N.R.A. had even thought of such a development.

The reorganisation of the danger buildings at Woolwich has led to the formation of a new department which will be known as the Royal Lyddite and Cordite Factory. A separate staff will take charge of the new buildings which are being erected on the Arsenal marshes. It is to be presumed from the announcements which have been made that the safeguards which are enforced in the case of private factories will be observed under the new *régime* at Woolwich.

In going over a Paris gunmaker's price list we were interested in noticing to how great an extent England is responsible for the nomenclature of firearms. The following terms appear to be used with just the same freedom that is noticeable in our adoption of motor car terms such as chauffeur:— pigeon-gun, hammerless, top lever, double grip, "correct" as a trade mark for sporting guns, rook rifle, express rifle, ball trap, pigeon trap, revolver, "Velo-dog revolver" as a trade mark, choke-bored and others we may not have noticed.

The gunmaking firm of John Rigby & Co., Ld., must be credited with a notable achievement in having induced the Waffenfabrik Mauser to manufacture an enlarged sporting edition of their well-known military rifle, which is adapted for firing the Rigby ·350 high power express cartridge. Every convenience of the military model of weapon has been incorporated into its design, and we, therefore, see in it a weapon which should prove highly popular, both for deer-stalking in Scotland and for big game shooting in various parts of the world.

A great deal of publicity has lately been claimed for the doings of a South London rifle club upon the assumption that their performances approach the marvellous. In point of fact they occupy a position apart from other clubs, in that they use aperture sights and allow the back position of shooting. Under these circumstances the comparatively high scores they are in the habit of making are fully accounted for, but these are not, in our opinion, relatively superior to what is done by other clubs with sights more closely approximating to the military pattern.

The marvellous enterprise of the Normal Powder Company is often shown by the daring originality and effectiveness of their advertisement policy. The latest manifestation of this company's undoubted power in enlisting the sympathy and aid of their customers takes the form of a fifty-page pamphlet, which reproduces some 200 or so testimonials from sportsmen in all parts of the country. Not only are the opinions concerning Normal powder of a highly favourable character, but in every instance the full name and address of the writer are given as a proof of good faith.

A report and balance sheet has at last been issued showing the state of the finances of the Colt Gun and Carriage Co., Ld. The period reviewed embraces the past three years, and a loss of £16,912 is shown. The directors announce that valuable additional patents have been acquired far outweighing the depreciation of the original patents during the efflux of time. It seems that over £24,000 is claimed from the British Government, of which less than half has been received on account. What with changes of directorship and financial embarrassments generally the company appears to be in a very unsatisfactory state.

The report of the Midland Railway Rifle Club, which carries on shooting in a disused railway shed at Derby, shows an exceedingly healthy state of affairs. The Midland Railway Company made a grant of £250 for the equipment of the club, which, added to free range accommodation, places the club in a very favourable condition. No less than £131 10s. has been spent in the purchase of rifles. The equipment of the range cost a further considerable sum of money, and as a result thirteen members can shoot at one time. It is very pleasing to note that the club armament includes twelve Greener rifles, which shows that the rifle club movement certainly exercises an important influence on the fortunes of the gun trade. It seems that in the course of the year a sum of £89 was expended on ammunition.

GUN PROBLEMS IN 1816 AND 1821.

THE two letters which we print below were recently shown to us as interesting relics of a bygone time. The first letter certainly suggests that the firm of John Manton & Son, in the person of its spokesman, took a great deal of interest in the more scientific aspects of firearms manufacture. It is interesting to note that Manton wrote this long letter in excellent handwriting and perfect spelling without a single correction or erasure from one end of the missive to the other. The most curious feature of his writing is that on about half the occasions when he had occasion to use the letter "d" he finished it with an artistic flourish that curls back an entire inch over the previous writing. The discussion of relative quickness between different methods of ignition, and the suggestion that alleged differences are more a matter of imagination than fact, finds its echo in a recent article in the *Field*. The person to whom the first letter was addressed does not appear, but it was doubtless written to Sir Thomas Frankland, Bart., the recipient of the letter addressed by Dr. Wollaston. It would be very difficult to find an earlier anticipation of the modern cap than is contained in the criticisms and suggestions of Dr. Wollaston. These letters are the property of Sir Ralph Payne Gallwey, Bart.

GEO. H. MANTON TO SIR THOMAS FRANKLAND, BART.

SIR,—My father and myself are most grateful for your good wishes. Although the new locks prime themselves the charge is not inflamed by a train, which can never be so rapid as the expansion of flame. It is no criterion for the simplicity of the Forsyth lock for *general* use that it should succeed in your hands, for if under so good management it could ever fail, it would indeed be worth little or nothing. There is, in fact, a much greater *appearance* than *reality* of increased quickness, for although the explosion *seems* to answer more immediately to the pull, I much doubt whether the shot is delivered at the object (particularly at any distance) one atom sooner. I do not speak from prejudice or from my own experience alone, but from general report and from the observations I have made on the shooting of others when I have seen them used. Lord Middleton only a few days since in some degree proved this, though he did not give a reason and would not hear mine. He has now making a double rifle and two double guns, one with Forsyth locks the other with the new patent. His Lordship's observation was, when speaking of the advantages of a fulminator, that having two guns out and shooting alternately he killed the bird as *dead* and as *well* with the one as the other, though the flint lock *appeared* to hang. If shooting in the same style, the one sounds as well as the other there can be no great difference in time. Lord Pollington has tried them three years at pigeons, but I have never seen him shoot well, and he has always succeeded when he laid them aside and used his flint lock gun. I saw him one day strike 13 following but not one dropped, though I have occasionally seen him kill, but it was always a shot at no great distance. It is but a fortnight since that his Lordship took one to Highbury, struck four pigeons but not one came down. He then borrowed a gun from one of the Club and killed 16 out of 19 dead. He later killed a double shot with the Forsyth, but in that case they stand so near the trap that the second bird was not more than 25 yards. I have shot our guns against Lord Pollington's in his presence and also against several others, and I have always beat them in *strength* one third, sometimes by one half. The way therefore in which I account for what I state as to the *appearance* only of quickness is that what a Forsyth gains in the explosion it loses in the passage of the shot from the gun to the bird, for the charge which goes one-third stronger must pass in so great a proportion quicker through the air. I have tried several of the barrels such as you describe but I have not yet found anything extraordinary in their shooting, and I should therefore think that the excellence of shooting in the gun from Calvert's (?) was more owing to the chance of its being a particularly good one than to the quality of the metal, as the mixture of iron and steel is not likely to allow so equal an expansion, and though it may shoot strong, cannot in general increase the closeness. If the guns are still to be had it would be as well to shoot them both as a more accurate experiment, for the one already tried may not perform so well again, but if they both prove superior it will certainly appear that some advantage is gained, and I should think nothing a trouble from which any improvement is to be acquired. We shall be most happy to make you a gun, though the one you describe is too wide in the bore for the length.

I am, Sir, your obliged and humble Servant,

G. H. MANTON.

Dover Street, *April 11, 1816.*

DR. WOLLASTON TO SIR THOMAS FRANKLAND, BART.

DEAR SIR,—Although it is perfectly true that a certain *modification of a common lock*, with which I first tried detonation was defective, I have nothing to say against *detonation* itself. The satisfactory certainty of the fire, and instantaneity of the operation, give it so decided a preference to the flint lock, that the only question in my mind is what modification of detonator to adopt. I have not hitherto tried anything but the patch, so that although I have seen most of the varieties of construction, I do not feel qualified to recommend any one in preference. The application of the little patch is at best tardy and in cold or windy weather somewhat difficult. Cartinel's (of Doncaster) method of preparing a set of pegs at home with patches ready for the field is neat and effectual, but I think I should prefer the cap or other primer to be thrown away to pocketing the empty pegs. But I have not seen the cap used, nor indeed have I yet seen a form of cap that satisfies me. Those which I have seen are of too conical a form, so as to appear in great danger of dropping off. But if the cap were made cylindrical at its lower part so as to grasp firmly a cylindrical touch-hole I should prefer it to Manton's tube, which from having copper on both sides of the priming requires a *violent* quantity of prime to ensure the firing. Otherwise his apparatus is the best finished work I have seen.

Believe me, dear Sir, very truly yours,

W. H. WOLLASTON.

14 Buckingham Street, Fitzroy Square,
September 13, 1821.

Mr. F. W. Jones has just been elected a member of the Livery of the Gunmakers' Company by presentation. It is interesting to note that this honour has only been accorded to one other individual during the 268 years of the Company's existence.

TRAJECTORY CURVES FOR THE MILLION.

THE most accurate methods for determining the elements of a trajectory curve are not simple, consequently there are many approximate rules, which have been from time to time suggested, which, although not absolutely exact, give the answer correct to as many figures as it is usually stated. Those who spend much time on calculating trajectories, feel indebted to the many workers in this field who have at times simplified the methods for arriving at the values required. For instance, the man who first pointed out that one minute of angle is approximately equal to one inch for every 100 yards of range, placed almost every marksman under an obligation. The very obviousness of this approximation probably prevented the discoverer from receiving his full share of credit. We, amongst the humbler ballisticians, are ever on the look out for simplification which will lessen our work when determining the elements connected with a trajectory. The publication of an article in the *Proceedings of the Royal Artillery Institute*, in January, entitled, "A simple method of determining the angles of descent of the ordinates of Trajectories," by Major Close, appeared to be just in our line, and we therefore applied ourselves to the task of appreciating the gift of this officer's ingenuity.

If the term simple is used in a comparative sense, we must beg to differ from this description of Major Close's method. Certainly no one could reasonably maintain that the proposal is more simple than the methods explained in the text books of gunnery, or that it is more accurate. On the question of simplicity we will give one example, viz., that of determining the highest point of a trajectory. Sladen's formulæ for direct fire is height = $(2\ T)^2$ where T equals the time of flight for the range considered. Major Close's analogous formulæ (No. VI) is:

$$\text{height} = 2\ x \sec \beta \cos \frac{\alpha + \beta}{2} \operatorname{Sin} \frac{\alpha - \beta}{2}.$$

where x is a smaller range known to require the angle β and the angle α is that of the range of which it is required to ascertain the maximum height of the trajectory. In the first place no one could say the latter expression is simpler in appearance than the former. Moreover, the values of x and β must be obtained from the usual gunnery tables, so that it is difficult to understand how any advantage can follow leaving the tables at this stage to complete the arithmetic. Accuracy is not the inducement, because the expression for obtaining trajectories contains an awkward term, viz., the angle made by the tangent to the trajectory at the point considered with reference to the line of fire. This is neglected, although it amounts, with the ·303, to 1·9 ft. in a 2,000 yards range.

We cannot help thinking that ballisticians will wonder why their solitude has been disturbed by a method which, to say the most of it, will not give an answer to their problems with less labour. Certainly a student who will not take the trouble to master the usual tables is not likely to attempt to understand Major Close's so-called simple method. In our opinion, it is of academical rather than practical value. It is doubtless a fine form of mathematical gymnastics for a student, since it illustrates the value of approximation by an infinite series. It also affords good practice for trigonometrical identities. This, however, hardly carries out the promise of simplicity contained in the title of the article.

CORRESPONDENCE.

THE NEW SHORT RIFLE.

TO THE EDITOR OF *Arms and Explosives*.

SIR,—I am greatly interested in your article upon the Small Arms Committee, and think your idea of abbreviating the Committee instead of the barrel of the rifle is excellent, and your foresight will be greatly appreciated. At present, the figure of merit of the Committee is too high and the pressure too local.

As a member of the National Rifle Association I have learnt a little bit about the shooting of the ·303 long rifle, and I am surprised to see that members of the council, who are also upon the Small Arms Committee, have swallowed the figures which are published in the parliamentary paper. This is probably due to their modesty.

Shooting, unlike fishing, seems to demand an attitude of reserve. Their shooting note-books must, of course, contain records of shooting with the long rifle far superior to the best of the short rifle records as displayed in the recent parliamentary paper. It is doubtless open to them to compare the figures the war office have published with the better class of shooting done in an ordinary Bisley competition. At 200 yards the normal accuracy of the long rifle is given as 3·24 inches. Even the school boys year after year will make better targets than 2·52 ins. which is the miraculous (!) figure quoted for the short rifle. From an intimate knowledge of the long rifle I should say that 1½ to 2 ins. would be nearer what should be expected at 200 yards when firing from a fixed rest, and slightly better when the firing is done from the shoulder of a crack shot.

At 500 yards, 7·44 inches is not even average; in fact, the maximum figure of merit for ordinary service ammunition is, I am told, 8 ins. I have seen published diagrams made with service cartridges giving a figure of merit of 4·25. Six inches is quite mediocre, and the short rifle with the published accuracy of 8·52 would obviously be condemned at Enfield; and even our rifle clubs, which are prone to sacrifice quality for cheapness, would jib at this as a gift. With regard to the 1,000 yards record, there again the shooting man will hardly recognise these figures as being anything like representative. Those who saw Wallingford's magnificent shoot in the "Palma" Match, 1903, 15 rounds with a long rifle and service sights, giving a mean figure of merit of 9½ ins., will wonder why the Hythe officials did not invite the same expert to shoot with the long rifle on the Hythe ranges, where they credited that rifle with 20·64 ins., or nearly a foot above the "Palma" record.

I will certainly admit that on the occasion referred to he did not shoot service cartridges; but, at the same time, it only goes to prove that with proper ammunition the long rifle could beat the short rifle on its own figures. In the "King's Prize," and other competitions at 1,000 yards, a 14 in. figure of merit is not exceptional in any way under service conditions.

Unfortunately, I do not know much about results at 1,500 yards, as we have no ranges at that distance; but I have seen a magnificent diagram fired by one of our best shots using the long barrel and match sights at a distance between 1,400 and 1,500 yards. He obtained a figure of merit of 2·06 ins. for 15 rounds. This makes the published figures of

merit of 53·16 ins. look ridiculous. The weather may not have contributed to give good results at the time these trials were fired, but whatever may be the excuse, they should have obtained something which approximated nearer to the common knowledge of shooting men regarding the long rifle than these outrageous figures.

CYCLOPS.

TRADE MARKS.

ADVERTISED. JANUARY 4—25, 1905.

268,577. The word MONOBEL to apply to explosive substances. Nobel's Explosives Co., Ld, Glasgow, December 13, 1904.

REGISTERED. DECEMBER 28, 1904—JANUARY 18, 1905.

266,253. Curtis's & Harvey, Ld.
267,019. } The Schultze Gunpowder Co , Ld.
267,020. }
266,223. L. Jeffries.

APPLICATIONS FOR PATENTS.

DECEMBER 19, 1904—JANUARY 21, 1905.

27,706.* Nitroglycerin. A. Mikolajczak. (Date of application in Germany, March 19, 1904).
27,749 * Automatic Spring Guns. E. Müller-Bralitz.
27,761. Projectiles. R. A. Hadfield.
27,838. Range Finder. C. and H. C. Beck.
27,912.* Small-Arms and Cartridge Cases. H. W. Holland.
27,974. Rifle Range. J. Gorst.
28,041. Detonator. R. H. F. Rennick, and Aërators, Ld.
28,146. Automatic Small-Arms. The Mars Automatic Pistol Syndicate, Ld., and C. Brown.
28.189. Targets A. B. Carey.
28,256. Explosives. N. Caipek.
28,376.* Explosive. Hudson Maxim.
28,397.* Small-Arm Locks. F. M. Deming.
28,435. Fuse Cases for Blasting Cartridges. E. Allday.
28,518.* Indicating Presence of Inflammable Gases. H. Tiersch.
28,540. Gun Sighting and Range Finding. G. E. Ward.
28,650. Cartridge Carrier. J. J. Burnett and C. Bubear.
28,651. Cartridge Carrier. J. J. Burnett and C. Bubear.
28,750 Sighting and Firing Guns. R. G. Tyler.
28,777.* Ordnance. C. D. Abel (Agent for *Rheinische Metallwaaren-und-Mf.*).
28,781.* Gallery Cartridges. T. S. King and J. E. Bell.
28,805.* Small-Arm Sights. G. B. Araldo and L. Barabino.
28,808.* Dinitroglycerin. Centralsterre für Wissenschaftlich-Technische Untersuchungen G.m.b.H. (Date of application in Germany, March 18, 1904)
28,866. Telemeter Testing. A. König.
28,881. Breech-Loading Small-Arms. C. Ryland.
29,056.* Blasting Compound. G. Dittmar.
29,076. Ordnance. Sir W. G. Armstrong & Co., Ld., and S. M. Murray.
29,121 Projectile Fuses. J. E. Read and C. W. F. Lester.
29,304.* Small-Arm Locks. B. Balay and L. Seefchlner.
29,305. Range Finder. G. M. Lauford, D. S. Capper and T. Kirkland.
29,423 * Automatic Guns. A. T. Dawson and J. Ramsey.
29,432.* Sporting Guns. L. Charlin and J. Santiot. (Date of application in France, March 18, 1904.)
29,433.* Sporting Guns. L. Charlin and J. Santiot. (Date of application in France, July 26, 1904.)
29,459. Explosives. W. G. Brodie and the British Moss Litter Co., Ld.
29,524. Range. W. H. Ell.
29,571. Rifle Carrying. T. S. Forbes.

1905.

13. Small-Arm Sights. T. Gilbert-Russell.
216. Torpedoes. G. W. Bell and F. M. Hale.
296.* Shot Guns. W. Smith. (Date of application in U.S.A., February 20, 1904.)
301. Small-Arm Cartridges. F. W. Schroeder and A. C. M. Jenkins.
333. Small-Arm Sights. J. E. Livsey.
362.* Ordnance Sighting. C. D. Abel (Agent for *Rheinische Metallwaaren-und-Mf.*).
524. Targets. W. C. Savage.
601. Blasting Explosive. J. Russell.
640. Projectiles. A. T. Dawson and L. Silverman.
675. Single Trigger Mechanism. W. Baker.
690. Gun-Controlling Mechanism. The British Thompson-Houston Co., Ld. (Agents for *The General Electric Co., U.S.A.*).
866. Rifle Sights. J. T. Peddie.
982. Mine Destroyer. F. Stolle.
1,055. Pigeon Traps. J. H. Hannay.
1,064. Automatic Firearms. R. H. Kjellman.
1,203. Gun Sights. R. G. E. Leckie and D. Watson.
1,223. Ordnance Breech Mechanism. A. J. Dawson and G. T. Buckham.

*These Applications were accompanied by Complete Specifications.

SPECIFICATIONS PUBLISHED.

DECEMBER 29, 1904—JANUARY 16, 1905.

COMPILED BY HENRY TARRANT.

26,868 (1903). **Automatic Rifle Mechanism.** C. A. T. Sjögren, Sweden. In patent No. 14,661, 1901, a system of automatic rifle mechanism was set out. In the present patent a modification is dealt with. The alteration allows of the use of a weaker spring than heretofore to return the breech mechanism, the firing pin spring being compressed when the breech is being opened—not during the return journey. Accepted December 8, 1904.

27,076 (1903). **Telescopic Sights.** J. R. Dallmeyer, London. A low power telescope adapted for gun-sighting, which is so constructed as to possess a very large field with good illumination and a large emergent pencil. The objective of the ordinary telescope is substituted by one consisting of a compound lens similar in nature to a photographic lens. This is combined with an ordinary terrestrial eye-piece and cross wires. The sight is especially suited for night-sighting. Accepted December 8, 1904.

27,264 (1903). **Fire-arm Sights.** L. G. P. Thring, Guildford. A system of sighting designed especially to prevent the diminution of light coming from the object caused by the back sight. The foresight, eye and object, are in one line, but the backsight is arranged at one side of this line. A separate line of sight is made through this backsight, and a subsidiary sight fixed to one side of the foresight. Accepted December 12, 1904.

27,519* (1903). **The Ross-Banister Single-trigger Mechanism.** Kew Gardens.

28,053 (1903). **Railway Detonator Signals.** G. Seuthe, Germany. A detonating signal is so constructed that no flying fragments are created. The train passes over a tube of metal containing an igniting mixture. The ignition of this mixture detonates the main charge, which is arranged in a non-metallic case, situated at one side of the line. Accepted December 21, 1904.

28,785 (1903). **Gas Ejector for Ordnance.** A. T. Dawson, London, and J. Horne, Barrow-in-Furness. In order to eject the spent gases from the barrel of a big gun, and so to prevent them being blown back by a head wind when the breech is opened, a supply of compressed air is provided. The air is drawn either from the ship's air pressure system, or from a compressor with a receiver, which may be installed in a position convenient to the mounting. Accepted December 15, 1904.

924 (1904). **The Propulsion of Torpedoes.** T. J. Croker. (This Specification is a secret document).

1,370 (1904). **Small-arm Sights.** F. E. Cowin and J. W. Allen, Coventry. A backsight, principally intended for spring guns, is formed in two parts. One is secured to the barrel, whilst the other is adjustable on the rigid part. Loss of strength in springs or other variations may be compensated by an adjustment of the moveable part. Accepted December 22, 1904.

2,926 (1904). **Device for Setting Fuses.** A. T. Dawson and G. T. Buckham, London. A device is so constructed that

the personal error in setting fuses is eliminated. The device is adapted angularly to displace the fuse ring to the exact range to which the device is itself set. A spring catch drops into a groove aud so mechanically indicates when the ring has been sufficiently rotated. Accepted December 8, 1904.

3,561 (1904). **Ordnance Firing Mechanism.** A. T. Dawson and G. T. Buckham, London. In place of the ordinary percussion or electric ordnance firing lock, one of the magazine rifle pattern is used, so that an ordinary rifle cartridge without the bullet may be employed as a percussion primer. The magazine can of course be attached also. This firing device is applicable to breech mechanism of the kind set out in Patents Nos. 19,026, of 1895; 15,975, of 1902; and 13,470, of 1903. Accepted December 22, 1904.

4,028* (1904). **Blasting Compounds.** A. F. Hargreaves, Roslin, and Curtis's & Harvey, Ld., London.

4,537 (1904). **Howitzer Field Carriages.** W. Beardmore, G. A. Kohler, and E. A. Mascall, Glasgow. A field carriage for howitzers, specially constructed to allow a rapid manipulation of the gun from the high angle position to the loading position and *vice versa*, without altering the line of sight. A modified form of spade for the trail is also dealt with. Accepted December 31, 1904.

4,789 (1904). **Disappearing Targets.** H. G. Dee, London. A target, or series of targets, is mounted upon a carriage through the medium of an oscillating roller. The carriage may be worked on wires between the firing point and the butts, and by means of a bell-crank lever the targets may be caused to disappear and to re-appear. The whole device is actuated from the firing point. Accepted December 31, 1904.

4,870 (1904). **Ammunition Hoist.** Sir W. G. Armstrong, Whitworth & Co., Ld, and C. H. Murray, Newcastle-on-Tyne. To save time in the transference of hoisted ammunition between gun platform and breech, three rammers, working simultaneously and controlled by one lever, are employed principally to deal with the explosive. Hand transference is obviated in this manner. Accepted December 31, 1904.

5,732 (1904). **Small-arm Trigger Mechanism.** Lieut. S. Turndija, Austria. In conjunction with rifle trigger mechanism, what is called a "check-bar" is used to indicate to the shooter the moment when the sear nose is leaving bent. The finger is caused by the check-bar to feel the trigger after a sliding movement over the bar. Accepted December 22, 1904.

6,141 (1904). **Cartridge Pockets for Belts.** P. A. Martin, Birmingham. A double pocket pouch is made by folding a single blank of leather or webbing, and stitching together the meeting edges. The sleeve so formed is doubled upon itself and the parts brought together and rivetted to form a partition between the two pockets so constructed. Accepted December 15, 1904.

6,353 (1904). **Blasting Compounds.** A. F. Hargreaves, Roslin, and Curtis's and Harvey, Ld., London. A blasting explosive in which either sodium chlorate or the perchlorate of potassium, sodium or ammonium is used as an ingredient, and into which blasting gelatine also enters. The last-named substance envelopes the crystals of the chlorate or perchlorate and renders them safe and waterproof without detracting from, but rather adding to, the explosive effect. Accepted December 15, 1904.

10,540 (1904). **Ordnance Cartridges.** A. Reichwald, London (Agent for *Fried. Krupp, Ag., Germany*). In place of the auxiliary charge contained in a bag and generally used between the ignition device and the charge proper, the auxiliary charge is carried in a bell-shaped hollow in the base of the cartridge case. By this arrangement the charge cannot get loose and be dispersed, and its action is, therefore, rendered certain. Accepted December 31, 1904.

10,542 (1904). **Ammunition Limbers.** A. Reichwald, London (Agent for *Fried. Krupp, Ag., Germany*). The members of the crew of a field gun are protected by a shield device attached to the ammunition wagon. The door of the wagon which forms the shield projects rearwardly when opened in such a fashion as to roof-in the space occupied by the men when taking ammunition from the wagon. Accepted December 31, 1904.

17,856 (1904). **Automatic Pistol Mechanism.** The Webley and Scott Revolver and Arms Co., Ld., and W. J. Whiting, Birmingham. Pistol mechanism of the automatic type is so arranged that when the last cartridge from the magazine has been fired, the breech block is held in its rearward, or open, position ready for the reloading of the magazine. The hammer acts as a catch to hold the breech block against its return movement, the magazine platform putting the sear out of action and so freeing the hammer for this purpose. Accepted December 22, 1904.

18,808 (1904). **Rifle Rest.** Lieut. B. Rüthling, Germany. A rifle rest consisting of three supports which are connected by a junction piece adapted to support the rifle. The inclination of the legs may be varied to suit the height of the shooter; and one leg is provided with notches to adapt it for use as a rifle rest when in the horizontal position. Accepted December 22, 1904.

19,194 (1904). **Small-Arm Projectiles.** H. Jones, Bersham. In order to retain "unity in longitudinal form for a distance," two bullets are joined, the nose of one fitting into the base of another. This form of projectile is constructed for small-arms and Maxim guns. Accepted December 22, 1904.

19,231 (1904). **Self-Propelling Projectile.** Max. W. T. Unge, Sweden. A self-rotating propelling projectile is provided at or about its centre of gravity with a balance ring which bears against the walls of the tube giving direction to the projectile. The projectile is allowed to rotate about its natural axis of rotation, which is said always to be different from the geometric axis on account of imperfections in manufacture. Enhanced accuracy of flight is claimed for this construction of projectile. Accepted December 31, 1904.

21,456 (1904). **Railway Detonator Signals.** J. V. Burris and F. W. Kerr, U.S.A. Apparatus adapted to fix beneath the rail and to contain a supply of detonators which may one by one quickly be carried into position after each discharge. A needle is operated by the wheels of the passing train. This needle contacts with the detonator, and explodes it. A string is pulled and the spent detonator is discharged and a new one automatically drops from a magazine into its place. Accepted December 22, 1904.

22,956 (1904). **Ordnance Sighting Attachments.** Fried. Krupp, Ag., Germany. When sighting devices are removed from their attachments there is a danger of the interlocking faces becoming damaged by blows or clogged with dirt. To prevent this the faces are protected when separated by two dummies shaped to fit them the same as the attachment head fits the sighting device. Accepted December 8, 1904.

23,369 (1904). **Ordnance Sights and Mountings.** P. M. Justice, London (Agent for *The Driggs-Seabury Ordnance Co., U.S.A.*). A mounting and mechanism through which ordnance may be quickly and accurately trained, either from the shoulder bar or by power gearing. The gun may be adjusted in elevation whilst the line of sight is kept on the target. The upper carriage is trained on the fixed lower mount Accepted December 15th, 1904.

24,782* (1904). **An Improved Gunpowder.** C. Duttenhofer, Germany.

25,028 (1904). **Automatic Pistol Mechanism.** W. J. Whiting, Handsworth, near Birmingham. Improvements on the mechanism described in Patent No. 3,820, 1904, are dealt with in this specification. A device for retaining the breech slide in its rearward position after the firing of the last cartridge from the magazine; simplified mechanism for the prevention of double discharge; a simplified safety device, and a general arrangement of the parts to allow of easy dismounting and assembling, form the subject matter of the specification. Accepted December 22, 1904.

25,797 (1904). **Explosive Manufacture.** J. Y. Johnson, London (Agent for *Soc. Anonyme des Poudres et Dynamites, Paris*). In specification No. 14,827, 1903, a method of lowering the freezing point of nitroglycerin was described. The same object may be achieved by mixing solid nitrated derivatives of toluene in such proportions that the mean melting-point causes the mixture to be a liquid body. Accepted December 31, 1904.

25,900 (1904). **Blasting Fuse.** A. G. Bloxam, London (Agent for *Roburitfabrik Witten u.d. Ruhr, Germany*). A cap carrying a detonator is arranged in the end of the fuse card case. Friction wires are so arranged that when they are forcibly pulled from the holes in the side of the cap and case the detonator is fired The construction of the fuse obviates accidental ignition. Accepted December 31, 1904.

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* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

A BLASTING EXPLOSIVE.

4,028 (1904). A. F. Hargreaves, Roslin, and Curtis's & Harvey, Ld., London. The special advantages possessed by chlorate of potassium as an ingredient of blasting explosives are discounted by its excessive sensitiveness. The patentees combine it, together with a nitro-hydro-carbon, with an agent which is in itself an explosive, but which, nevertheless, renders the chlorate of potassium safe and waterproof.

The agent consists of blasting gelatine. This explosive is of a plastic nature, and when used in certain proportions it envelopes the crystals of the potassium chlorate, and any nitro-compound mixed therewith, adding to the explosive power of the mixture so formed. The gelatine can be used in larger proportion to the chlorate of potasssium than is permissible with any substance which is itself non-explosive. The blasting gelatine used is, as is usual, nitroglycerin, to which has been added sufficient soluble nitro cotton to convert it to a jelly.

A mixture is first made of about 78 per cent of chlorate of potassium and 22 per cent. of di-nitro-toluene. To 75 per cent. of this mixture is added 25 per cent. of the blasting gelatine referred to, consisting of 90 per cent. nitroglycerin and 10 per cent. collodion cotton. The proportion of blasting gelatine to chlorate mixture may be varied within fairly wide limits, the properties of the resulting explosive being accordingly modified. As little as 15 per cent. of gelatine may be used, but it is found to be advantageous to increase rather than to decrease the proportion of this constituent. In some cases the presence of a small quantity of wood meal adds to the keeping qualities of the explosive, about three per cent. of this material being sufficient when introduced into the finished product. Accepted December 15, 1904.

THE ROSS-BANISTER SINGLE-TRIGGER MECHANISM.

27,519 (1903). J. Ross, and F. H. Banister, Kew Gardens. A system of single-trigger mechanism in which a "switching arm" is the sear lifting medium is described in this specification. In one form of the mechanism three pulls are necessary to convey the arm from beneath the right-hand to beneath the left-hand sear. But in another form the recoil of the first discharge is caused to jar a pivoted part into the path of the arm, and so to intercept the involuntary pull brought about by the recoil.

The parts are illustrated in the drawings reproduced. The trigger *a* is arranged as usual, and, pivoted in its centre is the switching arm *b* carrying at its rear end the projection *c*. The arm *b* is capable of a swinging movement in a lateral plane between the two sears. The spring *d* endeavours always to force the arm over to the left-hand sear. Situated just at the rear of the arm projection *c* are three teeth, or barriers, *e*, *f* and *g* (Fig. 4), which are adapted to engage the projection and to hold the arm at intervals during the lateral travel. These teeth form part of the limb *h* which is so pivoted to the trigger plate through the slots *i* and *j* as to be capable of a circular rearward movement against the pressure of the spring *k*.

When the gun is opened to reload, the turning of the top lever causes the bolt *l* to engage the shoulder *m* of the switching bar *b*, and to turn the bar over, against the pressure of the spring *d*, to a position beneath the right-hand sear (Fig. 4). During this movement the tail *c* engages the locking device *h* and forces it rearwards out of its path. When the arm is beneath the right-hand sear tail the part *h* is forced forward by the spring *k* and its tooth *e* holds the arm, and prevents its return. When the trigger is pulled the arm *b* is raised, and the right-hand barrel is discharged. The projection *c* is lifted above the barrier *e*, and is carried into engagement with the more elevated intermediate tooth *b*. With the involuntary release, the projection slides down, only to be brought up against the third stop *g*. The involuntary pull follows and, releasing the projection from this third barrier, allows the arm to proceed to a position beneath the left-hand sear. The parts are then ready for the second discharge.

In place of the third stop *g* the pivoted part *n* may be used. This part is shown in the detailed illustrations. It is pivoted in a slot in the trigger plate, and is controlled by a small spring. The recoil jars this part forward momentarily into the path of the arm *b*, and

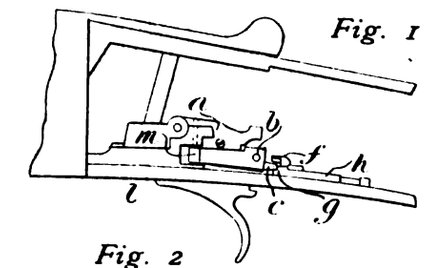

Fig. 1

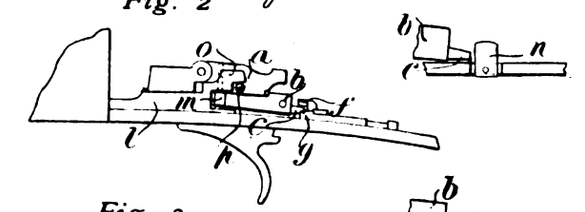

Fig. 2

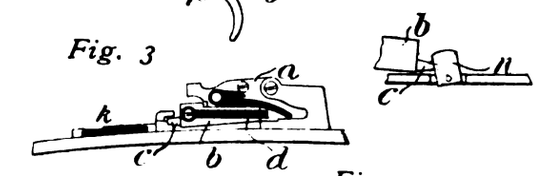

Fig. 3

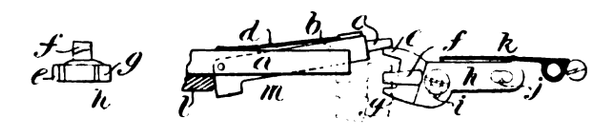

Fig. 4

so prevents the involuntary pull from lifting the left-hand sear. In order to lock the trigger when the arm *b* is being switched from the left-hand to the right-hand lock the hook *o* is provided on the cocking bolt *l* (Figs. 1 and 2). This hook engages the pin *p* on the trigger and prevents the inadvertent raising of the arm *b* whilst it is passing the locking part *h*. Accepted December 15, 1904.

AN IMPROVED GUNPOWDER.

24,782 (1904). C. Duttenhofer, Germany. In the manufacture of gunpowders, neutral bodies such as vaseline or camphor have been added to lower the combustion temperature and so to diminish or entirely to obviate, the muzzle flame resulting from the explosion of the powder. Compounds possessing a very high combustion temperature, such as nitrocellulose-nitroglycerin powders, require the addition of such quantities of these neutral substances that their ballistic efficiency is decreased.

The patentee has discovered that a small addition of say one to two per cent. of an alkali bicarbonate, such as bicarbonate of soda, and five per cent. of a neutral substance such as vaseline, to about 75 per cent. of nitrocellulose and 25 per cent. of nitroglycerin, constitutes a powder which will not give a flame at the muzzle. In addition powders so formed exhibit great stability, and it has been found that even when stored for years at a temperature of 50° C., they remain perfectly stable. The prejudicial effects produced by an addition of alkali carbonate to nitro bodies do not occur when alkali bicarbonate is added. Accepted Dec. 15, 1904.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

The Pistols Act.—The dispatch by the Birmingham and Provincial Gunmakers' Association of a circular letter of enquiry concerning the Pistols Act will doubtless perform a very useful office. It is not of course certain that the ultimate purpose of this communication will be fulfilled, since the amendment of existing legislation is only one degree less difficult of accomplishment than the passing of a new enactment. In so far that the London Association is acting jointly with Birmingham in the collecting of information it is only reasonable to suppose that the trade is unanimously of opinion that the Pistols Act has unduly injured legitimate business. The most prejudiced amongst us cannot deny the improved state of affairs which has resulted from the restrictions that are directed against hooligans and other equally undesirable persons. In the light of this experience it seems reasonable to suppose that, the authorities would refuse to entertain any demand for interference with the chief clauses of the Act. The sole hope of the gun trade is that it may be in a position to demonstrate that the sale of pistols to persons competent to possess them is too much wrapped around with red tape regulations. The Act admits in principle that the holder of a gun licence or game certificate is eligible to purchase a pistol. The requirement that this licence shall be produced at the time of purchase is, however, unnecessary; since it would be quite sufficient if vendors were allowed to adopt their own means of satisfying themselves that the purchaser is actually a licence holder. In the same way householders of a suitable number of years' standing might equally be allowed to purchase pistols without the permission of a magistrate or police inspector. To ameliorate the difficulties incidental to the proper authentication of a person about to proceed abroad is not so easy a problem, but we feel certain that a more workable arrangement than that laid down in the Act could be achieved.

Its Amendment.—Having shown how desirable it is that certain of the more arduous restrictions of the Pistols Act should be lightened in regard to purchasers of known standing in the community, the question that remains is how this may best be done. It should not be difficult to convince the Home Office that the Pistols Act was framed without a proper knowledge of the conditions of the industry concerned. No one appears to have noticed that the Act contained no provision for modifying the regulations in the light of future experience. It would for instance greatly facilitate the regulation of the trade in pistols if every dealer who desired to sell them were forced to register his premises for that purpose. At present an unknown number of dealers are selling pistols, and the sole means of reminding them of their responsibilty is to conduct prosecutions against infringers of the Act. These prosecutions follow in the nature of things after the harm is done. Gunmakers should not find much difficulty in convincing the Home Office that the purpose of the Pistols Act could in many ways be more satisfactorily effected under a carefully revised code of regulations, such as would combine a more complete protection of the general public with a higher regard for the convenience of the gunmaker and his customer. If the Home Office accepted this view of the case it would doubtless admit the necessity of modifying the present wording of the Act. Clause 3 as we have already pointed out in a previous article should be entirely deleted, and its place taken by one simple sentence

to the effect that the Home Secretary should have power to frame and enforce such rules as he might think desirable for regulating the retailing of pistols.

The Recognition of Chamber Sizes.—We are glad to be in a position to report from a large number of sources of information that the tendency to chamber guns nearer to the published sizes than ever before is gaining ground. In the hope of extending the guidance which is afforded by the ordinary table of chamber sizes we have reproduced in this issue a simple diagram showing the shape of cone and lead most suitable for joining a well-formed chamber to a well-bored barrel. It will be seen from the article referred to that we lay great stress upon the importance of always aiming at making the average chamber a little larger than the published minimum size. The slightest amount of tightness at the nose end of a gun chamber produces such a serious effect upon the shooting that the latest series of chamber sizes show the diameter at the front ·002 greater than ever it stood before. The intention underlying this change was to encourage the gun trade to adopt a somewhat larger size than was previously current. To those who have not formed definite opinions concerning the most desirable shape and dimensions of the particular parts of the barrel which are outlined in our sketch we would recommend a policy of whole-hearted conversion. We can at least guarantee that the form of cone and lead we recommended is not to our knowledge worse than any other. On the other hand we have the authority of a very large number of experimental investigations for saying that the shape recommended brings us nearer to the ideal 12-bore gun than any alternative with which we are acquainted. Our chief object in putting forward our own specification of cone and lead is the hope of being able to kill the idea that a long cone has anything whatsoever to recommend it. In just the same way we hope to obtain converts for our view that the greatest diameter of the secondary cone or lead should not exceed the size of the wadding. We feel certain that we cannot be very far out in our views, considering that the principles we are recommending for the shot gun are those which scientific research has shown to be most desirable in express rifles. One may hear references to long leads and short leads in weapons of this class, but the cone which diminishes the diameter to the extent of the thickness of the cartridge tube is as short as the mechanician can make it.

Technical Instruction in Gunmaking.—The prize distribution in connection with the Birmingham gun trade classes reminds us that this useful educational scheme has now been several years in existence. However much we may appreciate the importance of tuition in practical branches of the trade we shall continue to feel conscious of a gap so long as the semi-theoretical aspects of the gunmaker's calling are ignored. The all-round gunmaker must have something of a chemist's accuracy for the weighing of powder charges: he must know a certain amount of physics to enable him to appreciate the relation that exists between the actual making of the gun and its performances on the range. It is not sufficient to tell the ambitious student that a complete course of mechanical drawing, solid geometry and applied mechanics will put him in possession of a large amount of scientific material which will be useful to him as a gunmaker. What he wants is to know exactly those things which have an obvious and direct bearing upon his future work. In our "Lectures to Young Gunmakers" we have at times taken up the discussion of a number of elementary but practical aspects of gun testing, cartridge loading and so forth. That these articles are of genuine interest to the gunmaker is often proved to us by the fact that some of the most experienced and respected members of the craft have specially procured the back numbers containing these articles in order that their sons might read them. Education in technical matters is necessarily based upon the standard text books, and for want of a more co-ordinated treatise such articles as we have mentioned must be regarded as fulfilling the purpose of such works. The text book leads the way by classifying a subject into its several sections. In order that these may be brought clearly to the notice of the student it is necessary that he should attend a class where the teacher, having furbished up his own knowledge, will by practical demonstration impart the same facts to his audience. We know that if a suitable man could be found the technical education committee would be most happy to avail themselves of his services. It is just possible that these words may reach the notice of some technical draughtsman or other expert who, on thinking the matter over, may see that with a little trouble and perseverance he might be able to fill a gap that all of us must deplore.

The Vagaries of Local Inspectors.—The title we have used for this note was employed in this same paper some ten or twelve years ago. Local inspectors under the Explosives Act do not appear to have gained much wisdom in the interim. It seems that Mr. Newman Green, a publican of Christow, was asked by a police-constable if he could sell him some cartridges. From this we may assume that the publican was supposed to retail ammunition amongst his sporting friends, and that the police-constable required a few rounds for a purpose not specified. As three were supplied free of cost we must assume that the constable's intentions were not sporting but rather that he contemplated the destruction of some surplus cat or dog. Upon this trumpery evidence it seems that Superintendent Wood, armed with the powers of the Explosives Act, descended upon the poor publican and discovered 2,100 cartridges in a box four feet from the kitchen fire. It is terrifying to think that a similar visitation to our own home might produce equally serious evidences of criminal negligence. Superintendent Wood seems to have been instrumental in bringing the erring publican before a bench of magistrates. In order to convert the possession of 2,100 cartridges into a crime he estimated them to contain 50 or 60 lbs. of powder, which assumes a charge in each cartridge of about 170 grains. The solicitor for the defence stated that the prosecution would have to prove that the cartridges seized contained over 150 lbs. of powder before they could convict his client of exceeding the amount of powder which a person is permitted to store in a private capacity. We are not quite sure that the solicitor interpreted the explosives regulations correctly, but his argument was sufficient to cause Superintendent Wood to explain that the offence complained of was that of selling cartridges. This is the third original interpretation of explosives law which is conveyed to us by the transcript of the proceedings which have been forwarded to this office by a local reporter. Fortunately, the bench realised at this stage that the police had made a terrible bungle of the whole affair, and they dismissed the case.

THE NEW SHORT RIFLE.

THE merits and demerits of the new short rifle have been publicly ventilated during the past month, both in the *Times* and in the House of Lords. The very wide scope of this discussion has made it exceedingly difficult for the ordinary layman to form a satisfactory opinion as to the merits of the case on the one side or the other. It is possible to extract a few definite truths from the views of the various parties by examining their arguments and experiences in a spirit of mental detachment. First of all we may now feel quite sure that the particular type of short barrel which is used in the new rifle is neither so accurate nor so reliable as the 30-inch barrel of the old rifle. Whether this want of accuracy is an inherent property of the 25-inch length, or whether it is due to some abnormality which has not been made the subject of exhaustive experiment is impossible to say in our present state of knowledge. It is begging the question to suggest that accuracy is of little importance in military warfare. Inaccuracy destroys interest in target shooting, and so removes a great incentive to the soldier to understand his weapon. We must accordingly refuse to believe from the very slender information at present available that the requirements of our military service are best met by a rifle so utterly bad in nearly every respect as the new short Lee-Enfield. It seems almost certain that the Government will be forced to modify in a radical fashion their decision to re-arm the whole of our troops with the new weapon. It needs no special gift of prophesy to indicate the line which their future action should take. The Small Arms Committee should first of all be re-organised so as to have a minimum of three practical men upon it. Its members should then be instructed to find a stable system of breech mechanism capable of withstanding a service pressure of 20 tons on the square inch. Being thus assured of a suitable margin of strength exhaustive experiments should be conducted to ascertain the best specification of barrel and powder charge to impart to the existing bullet a muzzle velocity of 2,200 feet per second. There would be no difficulty in ascertaining incidentally the relationship of length of barrel to velocity and accuracy. In fact any intelligently devised series of experiments should be capable of defining the proportional influence of the various factors in rifle barrel construction.

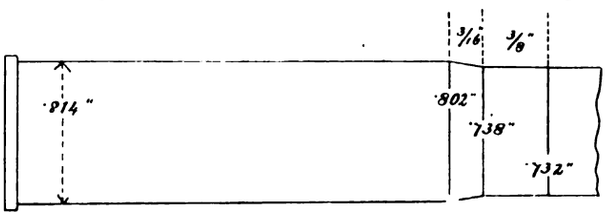
At present there is absolutely no research laboratory at the disposal of the War Office for the conducting of small arms experiments. A few officers here and there may make a hobby of some particular test or another; but this kind of work always suffers from want of co-ordination with some general scheme of research. The most nonsensical conclusions are frequently accepted with all seriousness; while on the other hand a particularly valuable piece of research may only be known to half a dozen persons. A trained research staff should not be difficult to select, and although money is supposed to be very tight at the War Office just now, the expenditure involved in the carrying out of such a scheme might be regarded as an insurance premium against £3,000,000 blunders such as the new rifle. It is not sufficient to hunt around for the best specification of barrel without knowing something about the cartridge. A research department would not require to work for many months before discovering that the immense size of the ·303 primer is a serious source of weakness to the cartridge case into which it is inserted. Further research should show that the absolutely square interior of the bottom of the ·303 cartridge case represents bad mechanical conditions. A few slight alterations in directions such as these should ultimately produce a satisfactory cartridge capable of imparting a high standard of velocity to the service bullet. The barrel and the cartridge would thus be co-ordinated one with another. In other words the Small Arms Committee have not yet learnt the way to set about their business, and they never will learn it until they are in possession of a research department capable of systematising the technical aspects of small arms construction. It would be a fatal mistake to allow the work of such a department to be dominated by the provisions of the Official Secrets Act. If a full report of each year's researches were published, the work of the department would be maintained in a high state of efficiency; first, by the criticism that wrong conclusions would evoke, and second, by opening up many channels of valuable private information. The slight disadvantage of sharing the results of our labours with other nations would be amply compensated by our own gain in efficiency. The entire explosives industry, and Woolwich in particular, owes much to the researches of Vieille and his colleagues. Why should we refuse to follow so worthy a precedent?

One of the most remarkable aspects of the recent discussion is that most of the knowledge on the subject seems to be in the hands of the private individual. The Bisley marksman and the trade expert appear between them to know more about rifles than the War Office. It might be argued that the War Office knows a great deal, but that it would be undigni fied to answer the charges that have been levelled against its competence. Against this view we have the parliamentary paper concerning the Hythe tests and Lord Donoughmore's speech in the House of Lords. In both instances we can be certain the best possible use would have been made of a strong case had such existed. When the War Office is reduced to answering allegations of inaccuracy by the assertion that fine shooting properties are not needed in a military rifle, and by sneering at Bisley marksmen because they do not do a cross-country run as a preliminary to testing rifles for accuracy then we are forced to the conclusion that the case for the new rifle is a very bad one. There may be excellent military reasons why our service arm should be shorter and lighter than the pattern adopted a decade ago. But the opinion of a soldier of the standing of Lord Roberts occupies quite a different footing from that of the expert. The latter should be able to show quite clearly what sacrifices must be made in certain directions to comply with a given military requirement. A service rifle must in the nature of things be a compromise, and to establish a workable compromise it is necessary to maintain a due sense of proportion. Too much must not be subordinated to any single requirement; and each reform must be gained at a minimum cost in other directions. Now, whatever may be the rights or the wrongs of the several debatable issues that have been raised, one definite conclusion seems to rise up clear and well defined. It is that the new rifle possesses far too many defects to justify an expenditure of three millions sterling for the re-arming of our troops therewith.

SHOT-GUN CONES.

THERE is one particular aspect of gun manufacture where theory and practice can be brought into very close harmony with one another. We refer to the specification of the sizes that should control the formation of the chamber, the cone and the lead of an ordinary shot gun-barrel. There are many gunmakers who devote an immense amount of time to supervising the manufacture of the guns that bear their name, but who do not sufficiently realise the importance of adopting a proper series of dimensions for the back end of the barrel. In the accompanying illustration we show the very simple series of sizes which we desire to recommend for general adoption. The two Gunmakers' Associations have taken an immense amount of trouble in drawing up a series of chamber sizes. We have made use of these in framing the accompanying sizes. This is not because the minimum chamber sizes have not already been widely disseminated, but because we firmly believe that more than one half the guns yearly manufactured suffer from the double defect of being too tight in the chamber and too long in the cone.

To deal first of all with the question of tightness in the chamber it is necessary to point out that the two Associations have never felt themselves sufficiently strong to name the actual dimensions to which a gun should be chambered. The statement of a minimum size infers the existence not only of a maximum size but of an average size as well. The very unfortunate result of stating only the minimum size of the chamber has been that those gunmakers who are most anxious to adopt the published sizes have fallen into the error of supposing that the greatest merit consisted in keeping closest to the theoretical minimum. This, of course, is against the entire theory of manufacturing between limit sizes. The two Associations having defined the minimum gun-chamber, the individual gun-maker will be putting himself on the safe side if he instructs the maker of his chambering tools to aim at a gun chamber exactly ·002 of an inch larger than the Association sizes. This average size is duly represented on the accompanying diagram, and we can assure our readers that guns chambered in accordance therewith will not cause split cases, nor will there be any lack of penetrative power. Every year the modern nitro-powder is increasing in strength and sharpness. More than this, the loading of cartridges is continually developing on sounder lines. The one thing that is able to neutralise the benefit of these improvements is a gun with an unduly tight chamber. Tightness at the nose is a much more serious fault than deficient diameter at any other part.



Having said this much about the chamber, we will now proceed to justify the form of cone depicted in the diagram. The object of the cone is merely to join the chamber to the bore. The cartridge has a certain interior diameter, the bore is approximately the same size, but smaller for preference. The firing of the charge projects the shot and wads from the cartridge case to the barrel. To perform this operation with as little disturbance to the charge as possible, it is advisable that the interruption between cartridge tube and barrel should be very short. A railway track makes pleasant going when the rails are well jointed. In just the same manner, the more smoothly the charge of shot is transferred from the cartridge case to the barrel, so the conditions that tend to improve pattern and penetration are best met. With a short cone the charge of shot jumps straight from the cartridge to the barrel without change of diameter and without allowing any gas to get by. On the other hand, in the presence of a long cone, which is still rather the rule than the exception, the column of shot, instead of jumping with unchanged diameter from the cartridge to the barrel, is liable to expand into the gap that is left. When pressed forward into the smaller diameter of the barrel, the column of shot cannot very well lengthen out: it is more likely to be squeezed in upon itself by the cone. This compression of the pellets is probably the most prolific cause of the patchy and irregular patterns that are encountered the testing of shot-guns. The pellets having once been squeezed into such close contact are loth to part, and as a result they form themselves into ill-assorted groups. The cone should not, of course, be made in the form of an absolutely square shoulder. This would produce a harsh and unyielding edge. Moreover, the cleaning of the gun would present many difficulties were the cone reduced to something in the nature of a shoulder. The happy mean between extremes may accordingly be defined as a cone as nearly as possible three-sixteenhs of an inch long.

Having shown that the cone covers only the difference of diameter between the inside and the outside of the cartridge tube, it will be apparent that an additional taper is desirable. That is to say, we know that the ordinary 12-bore wad measures on the average ·738 in. Assuming ·732 in. as the average size of a 12-bore barrel, we can quite see that the charge would enter the barrel with a decided bump if this resistance were concentrated on to one part. We have accordingly shown in the accompanying diagram, a three-eighths-inch lead which tapers from the ·738 in. of the wad to the ·732 in. of the barrel. The lead probably also serves the useful office of guiding the charge into the barrel so that the wads lie nice and square. To make the lead too open at the back is equivalent to lengthening the cone. It also improves pattern at the expense of penetration. We trust that our attempt to lay down the ideal in the gun chamber, the cone and the lead, will merit the attention of those to whom sound reasoning appeals. We do not claim the discovery as our own. It is merely based upon the views and experience of those who, in our opinion, have most carefully studied the relation that exists between the dimensions of the barrel on the one hand, and the behaviour of the cartridge on the other. The precedence of the British gunmaker is due to the manner in which he has at all times tackled the intricacies of his work. We think the points here brought forward are worthy of his careful attention.

SCIENTIFIC DEVELOPMENTS IN POWDER MANUFACTURE.

SEVERAL circumstances have arisen which enable us to refer once more to the subject matter of an article entitled "Tests of Powders," which appeared in our last January issue. Although our remarks were condensed into the very brief compass of a single column, we were able to explain certain views which have been received by powder makers as touching upon the problem of the hour. Five years ago we were in comparative chaos concerning the most desirable specification for a sporting nitro-compound. Pressure testing with lead crushers mostly governed powder manufacture; but the scientific relation of decrement and pressure was not well understood, neither was there any certainty as to the precise margin of safety that should exist between the proof and service pressure of sporting ammunition. The want of a definite standard of pressure was met by the gradual acceptance of the *Field's* suggestion of three tons as a reasonable average of existing practice. As the subject became better understood, and in the light of constant comparisons between laboratory tests and the behaviour of sporting cartridges in the field, it was soon recognised that a powder was all the better for being what is known as "on the high side."

Three tons pressure with a fresh sample of powder in a newly-loaded cartridge, and fired from a proof gun having a carefully standardised chamber, is a very different thing from three tons pressure in the field. A little openness in the chamber, storage during moist weather, a slight slacking of the turnover, any of these will reduce the pressure of a perfectly-loaded powder by a very substantial amount. When we add to these weakening influences in a well-loaded cartridge others that result from the use of inferior materials or bad workmanship, it will be understood that three tons obtained by the laboratory test with standard loading during the early part of the season, may come down to two tons when the same powder is later on loaded into a commercial cartridge and fired from an average gun. Short charges, deficiency or unsuitability of wadding, inadequate or loose turnover are defects which have not yet been eliminated from the commercial cartridge.

When we look around in order to find what defects of cartridge loading are likely to produce excessive pressure, we realise that they are very rarely encountered in general practice. At any rate, the mis-treatment that makes a violent cartridge cannot very well pass unobserved by he loader. If he inserts an excess of powder he is aware of an insufficiency of space for the proper complement of wadding and shot. The mistake of loading a condensed powder by bulk is unlikely to happen now that bulk powders are almost exclusively issued to the trade. Tightness of gun chamber, over-drying of cartridges, and other causes of increased pressure seldom operate to an extent that endangers the stability of the gun. We accordingly find that cartridges may give right up to four tons in the laboratory without leading us to suspect that they may prove dangerous in the field. For this reason there is a strong feeling, not only amongst powder makers, but amongst the more progressive of loaders, that the three-ton standard should be subjected to a slight increase.

The chief justification for increasing the allowable average of pressure in the lab. cartridge is that this class of test is almost invariably conducted with a charge of shot which is seldom used in the sporting cartridge. Every powder, whether it be of the 42 or 33-grain type, is tested with a 1⅛ oz. charge of shot. The almost universal charge for the sporting cartridge is a sixteenth of an ounce short of this limit. The 1 oz. charge is gaining popularity by leaps and bounds, and sporting opinion has of late found merit in the ⅞-oz. charge. The successful firing of these reduced charges demands an activity of combustion on the part of the powder which was not required in the presence of the confining influence of the full charge. A full load of shot, plenty of wadding and a tight turnover was the recipe for obtaining best results with the older nitros of ten or so years ago. Nowadays, the nitro powder is most successful which has an excess of strength to balance the diminishing weight of the shot charge. Then, again, the price at which cartridges have now to be sold necessitates the use of more second-quality wadding than was customary in times gone by. The deficiency of fibre is compensated by the use of hardening solutions; and a wad of this consistency, while it fills up the allotted space, does not exert on the powder the confining power of best felt. Here again, therefore, we have another argument that favours the adoption of a higher standard of pressure than has hitherto been considered needful.

The remaining portion of our space may be devoted to a consideration of the circumstances which justify the powder maker in demanding the acceptance of a nominal increase on the working load of the shot-gun. In the first place, this increase is only real for guns firing the full charge of shot. Pressure varies with the amount of the shot charge, and considerations of recoil make it unlikely that the shooter will habitually use heavily charged cartridges in a gun expressly made for light charges. Moreover, whether a gun is light or heavy it must receive the same proof, and therefore be of sufficient strength at the breech. Another point deserving of mention is the fact that thousands of shooters habitually fire cartridges giving over four tons pressure without noticing any signs of distress on the part of the gun. They may at times complain of bad pattern, heavy recoil, or defective killing power; but there is nothing to suggest undue strain.

In fact, summing up all recent experience, we encounter enough high-pressure cartridges in the course of a year to show us that the present conditions of testing properly standardised powders are such as to justify the acceptance of a higher level of pressure than is at present publicly recognised as admissible. Violence is seldom or never encountered in the standardised English nitro. We will admit that it is sharp in its combustion: we should prefer it still sharper. But the kind of sharpness we advocate does not make for violence. If the powder maker is allowed an extra half-ton of pressure he takes it, but no more. Years ago, when powders were more subject than at present to fluctuations of pressure due to variations in their percentage of moisture a greater margin of safety was necessary. But to-day the powder leaves the factory containing the amount of moisture it naturally holds under ordinary conditions of storage. Its ballistic properties are regulated in accordance with the moisture present, and the chances that the powder will ever gain in strength so as to threaten the stability of the gun are so remote that they can be ignored.

PISTOLS ACT CIRCULARS.

WE append herewith in order of date two circular letters which have been issued in collaboration by the Gunmakers' Association of London, and the Birmingham and Provincial Gunmakers' Association. In each instance the letters have been forwarded to gunmakers and others who are brought under the provisions of the Act. The Birmingham Association writes as follows:—

SIR,—The Birmingham and Provincial Gunmakers' Association have had numerous complaints made to them with reference to the working of the Pistols Act. It is contended that it does not properly effect the purposes for which it was framed, whilst it has seriously operated against the interests of legitimate trade in revolvers and pistols. It has been suggested that representations be made to the Home Office with a view to having the Act altered or amended. We shall be glad to have your views as to how this Act has affected your trade in pistols, also any suggestions you may wish to make for its amendment. A space for reply will be found on the next page, which kindly fill in and return, but please retain copy of Act for future reference.

(Signed) W. H. HUGHES, *Chairman.*
Proof House Hall, R. J. PETERSEN, *Hon Sec.*
Birmingham, January, 1905.

The London Association writes in the following terms:—

DEAR SIR,—The general experience of the gun trade in respect to the working of the Pistols Act, which came into force on August 11th, 1903, seems to be that, while it has done good by restricting the sale of pistols to undesirable persons, it has on the other hand placed undue obstacles in the way of those requiring them for legitimate purposes. My Association is collaborating with the Birmingham and Provincial Gunmakers' Association with a view to collecting information. I should accordingly feel obliged if you would tell me whether the formalities connected with sale of pistols to

(a) licence holders,
(b) persons requiring pistols for house protection, and
(c) persons requiring pistols in connection with an intended trip to foreign countries,

have lost you the sale of pistols which you would otherwise have been able to supply. In framing your reply please show as clearly as possible to what extent you have lost business of a legitimate nature and what reasons are mostly given by (a), (b) and (c) as above for refusing to purchase pistols through inability to comply with the conditions of the Act. I may inform you that if the response to this circular letter shows definitely that the Pistols Act, as now framed, is injurious to legitimate trade, we shall endeavour to secure some modification of its more hurtful sections.

MAX BAKER,
Effingham House, *Secretary.*
February, 1905.

If those members of the gun trade whose business has been injured by the provisions of the above Act will take the trouble to state their case with care and precision, there can be little doubt that an important body of evidence will be available, and it is impossible to think that the Home Office will be found lacking in willingness to set right what appears to be a serious injustice.

CORRESPONDENCE.

GUN PROBLEMS IN 1816 AND 1821.

TO THE EDITOR OF *Arms and Explosives.*

SIR,—I have recently been investigating the history of the percussion cap, the results of which I hope to communicate to you a little later on. In the meantime you may be glad to print the following poetical effusion which bears directly upon the subject of Wollaston's interesting letter of September 13, 1821, printed in your February issue. The verses, it should be noted, were written shortly after the patent trial of Forsyth *v.* Riviere, A.D. 1819, in which the validity of Forsyth's patent was upheld; and just before the publication of E. Goode Wright's paper in the *Philosophical Magazine* on the firing of gunpowder by fulminate of mercury. The two letters reprinted by you, and the following verses, therefore, refer to the various mechanical devices for firing gunpowder by means of the chlorate of potash mixture. Forsyth, it is true, refers to the fulminate as suitable for the purposes of percussion, but, so far as my researches go, there is no evidence of any but experimental uses of these compounds. I hope that this brief note may have the effect of eliciting further information as to the history of the invention of the copper percussion cap, which has been claimed on behalf of at least three individuals, e.g., Wright, Joshua Shaw, and the French Colonel A. D. Vergnaud.

PERCUSSION.

As sung by Mr. Dignus at the third medallic meeting of the O.H.C., at the "Hats," Ealing, July 7, 1820.

Air "Young Lobski."

On Scotia's hill a holy man
Struck out Percussion's deadly plan,
And fleeter wing'd Death's quick machine—
He distanced Doctor Guillotine.
He distanced Doctor Guillotine.

Prime agent of Percussion's reign,
Its glory shall Forsyth obtain;
The first the flint who did discard
May fairly claim a just reward.
A just reward, etc.

Of magazine some did complain,
And vowed it threatened senseless brain,
A safer mode by tube and peg
Is offered to the world by Egg,
World by Egg, etc.

In Piccadilly view the mart
For guns that boast Percussion's art;
His pegs and tubes so quick ignite
Much slower tools the fair delight.
The fair delight.

With care observe his copper cap,
Not opium gives so sound a nap;
With plaisters* can a shot be sure—
The quacks kill ten for one they cure.
For one they cure.

The triumph hail of modern art,
Percussion now has got the start!
All grateful souls will drop, at last,
A tear for Flint's last service past,
Last service past.

Sporting Magazine, N.S., Vol. vii., 1820—21.

Yours faithfully,
Clare, Sevenoaks, G. WYNDHAM HULME.
Feb. 21, 1905.

*Percussion primers of oxymuriate potash, etc.

ROUND THE TRADE.

The death is announced of Monsieur Alfonse Chassepot, inventor of the rifle of that name, at the age of 73 years.

Mr. Charles Rosson has acquired the business which was carried on for so many years by the late Mr. E. Wilson of Norwich.

The death is announced of Mr. R. H. Grant, aged 33 years, of 46 St. James's Place, third surviving son of the late Stephen Grant.

The Marylebone Gun Club made the distribution of their prizes by Lady Ludlow on the 1st. ult., the occasion of an enjoyable bohemian concert.

There is evidence in more than one quarter that the coming shooting season will see a marked extension of the specialised ⅞-oz. charge for 12-bore shot guns.

We are informed by the Normal Powder and Ammunition Co., Ld., that they have been appointed purveyors of smokeless powders to the King of Portugal.

The directors of Vickers, Sons and Maxim recommend a final dividend of 1s. 6d. per share, free of income tax, on the ordinary shares of the company, making, with previous payments, 12½ per cent. for the year. A sum of £190,000, is carried forward.

The report and statement of accounts of the Abbey Improved Chilled Shot Co., Ld., shows that the profit earned has enabled the directors to recommend the payment of a dividend at the rate of 3 per cent. on the ordinary shares and 5 per cent. on the preference shares.

The Wilkinson Sword Co., Ld., were favoured by the King of Portugal with a considerable order for sporting goods, which included ten guns and two rifles. We understand that this firm have recently completed a new model of revolver possessing several features of exceptional merit.

The decision of the Office of Works to grant a site in Richmond Park for the installation of a rifle range for club shooting represents a means of obtaining the necessary accommodation which might be adopted in other centres where the conditions are equally favourable.

With Sir John Heron Maxwell in the chair the annual dinner of the Middlesex Gun Club passed off very pleasantly on the 16th ult. Regret was expressed in the course of the speeches that the club has suffered a somewhat serious diminution of membership, and that there is great need for the infusion of new blood.

Mr. R. D. Robertson has issued a notice, from the Regent shooting ground of Finchley Road, N.W., to the effect that the partnership between himself and Mr. P. A. Stockbridge has terminated, and that Mr. Robertson will himself take over the personal supervision of the shooting practice and other work carried on at the ground in question.

The annual report of Messrs. Walkers, Parker & Co., Ld., shows a trading profit of £31,091. This is reduced to £9,474 by deductions for debenture interest and head office expenses. After adding £12,574 brought forward from 1903, there is an available total of £22,048. The directors recommend a dividend of 3 per cent. on the preference shares, which will absorb £6,000, and so leave £16,048 to carry forward.

Agitation is strongly proceeding against the intended removal of rifle manufacture from Sparkbrook. To reduce this factory to the status of a repair shop would inflict serious injury on many of the workpeople to whom it has hitherto been a source of livelihood. The War Office appears to be of opinion that efficiency will be gained by the proposed change. Its freedom of action is, however, threatened by the political pressure which has been brought to bear on the Government of the day. The taxpayer naturally desires that economy of administration shall take precedence of the claims of Government employees to a form of consideration which is denied to workers in private factories. This class of agitation comes singularly near to political jobbery.

The report of the Roburite Explosives Co., Ld., calls attention to the fact that the arrears of preference dividend amounting to £12,153, which were accumulated in consequence of the heavy legal expenses and loss of trade caused by the patent actions brought against the company in 1895-7, have now been discharged in full. The net profit for the past year is £8,330, making, with the amount brought forward, £9,585. Of this sum, £833 has been transferred to the reserve fund, and £7,409 has been allocated for a 15 per cent. dividend on the 10 per cent. cumulative preference shares, so, clearing up arrears as already described, £1,343 is thus carried forward.

The *Financial News* of the 23rd ult. contains an article warning British investors against being drawn into schemes for the manufacture of unfreezable dynamite. The article shows that the problem of lowering the freezing temperature of nitroglycerin by the addition of suitable ingredients was investigated by the late Alfred Nobel so long ago as 1886. This carries with it the assumption that if there were any obvious and convenient means of improving nitroglycerin explosives in this respect, the Nobel Company would have discovered it long ago. If, on the other hand, an outsider solved the problem, Messrs. Nobel would be more likely to buy the process than to allow a rival with so important an asset to set up in business against them.

The annual report and balance sheet of the New Explosives Co., Ld., discloses the very satisfactory net profit of £14,243, which is arrived at after deducting debenture interest, income tax and all trading expenses. To this profit is added the sum of £985 brought forward from the previous accounts. The directors recommend that £5,400 of this amount be utilised for a 6 per cent. dividend for the year, that £3,000 be written off the property purchase account, that £2,000 be added to the reserve fund making it £8,000 and that the remaining £4,828 be carried forward for working capital. It seems that during the past year the sum spent on repairs and renewals has been sufficient to ensure the maintenance of the Company's property and plant in thorough working order. The company are to be congratulated on having successfully negotiated the purchase of 21 acres of freehold land which is already in course of absorption for extensions of the factory area. Altogether the directors and their general manager may be congratulated on a very satisfactory year's transactions.

Mr. H. O. Arnold-Forster has given, in a letter to a correspondent, a summary of the past history and future arrangements for re-arming the artillery, and from it we make the following extract:—"The need for re-armament became apparent during the South African war, and on January 10, 1901, a committee was appointed to enquire into the question. Its first report was received on May 1, and in the same month designs for guns satisfying the approved requirements were called for. In February and March, 1902, orders were given to Messrs. Vickers, to Elswick, and the ordnance factories for sample guns. These were supplied during August and September. In December the committee were able to recommend that four experimental batteries should be ordered from the firms. The guns were to embody the best points of the weapons which had already been tested. As the whole of the work was new, and as materials had to be made and tested and patterns approved, the manufacture naturally occupied some months; but actual trials of the experimental batteries were begun as early as September, 1903. On October 6, after extensive trials of the limbers and wagons, the committee reported that certain important alterations were necessary for the purpose of giving additional strength. They were, consequently, re-designed and subjected to fresh trials. On March 30, 1904, the equipments which had successfully withstood the trials were finally recommended for adoption. The report of the committee as signed on this date was duly submitted to the Master-General of the Ordnance, who brought it before the Army Council on May 5. On the same day the first orders for the guns were sent to the ordnance factory."

TWO BOOKS ON PATENT LAW.*

THE change of procedure at the Patent Office has naturally made an extensive revisal of the published handbooks necessary. *The Inventor's Guide*, by Mr. James Roberts, Barrister-at-Law, is, however, a new book, but the author is already well known as an authority on patent law. In fact, the present work is frankly admitted to be founded on the author's larger volume, *The Grant and Validity of British Patents for Inventions*. That the author has conscientiously studied the leading authorities may be shown by the fact that he gives eleven abbreviations to signify the works of well-known writers, from whom he is in the habit of quoting. These references appear throughout the book, together with the number of the page where the original information may be found. In this way the business man or inventor is shown what authorities he should consult if he feels desirous of going into greater detail.

In reading a book of this kind it is surprising to find how many of the simplest aspects of the patent law are unknown to persons of wide general knowledge. The things which constitute patentable inventions, and those lying outside the boundary which legal practice has established, are very difficult to distinguish. We find, for instance, that the first condition for the grant of a valid patent is that the subject of it must be some manner of manufacture. It seems that the mere application of an old thing to a new purpose is not a manufacture unless the novel application amounts to a new machine or mode of production. The distinctions which lawyers have drawn as between what is patentable and what is not, are exceedingly puzzling to the member of the general public. The object of a book of this character is, however, amply performed if it gives a sufficient number of examples to enable the reader to find an analogy for the particular problem that is occupying his mind at the moment. The precise amount of ingenuity that must be exercised in the carrying out of a new idea introduces some peculiar manifestations of apparent injustice.

The portion of the book which deals with the newly adopted official search contains a number of interesting passages. We find it made clear, for instance, that out of four possible forms of previous publication, the search amongst British specifications covers only one of them. That is to say, the search does not cover foreign specifications, descriptions in books, newspapers, &c., or the use or exhibition of the invention by the inventor or others. It seems that the whole idea of the new regulations is to give power to the Patent Office to insert references to earlier specifications on the principle adopted in certain cases of opposition. It is clearly shown by the author that the new examination will not bring to light cases in which other inventors whose complete specifications have not been published, have applied for a patent for the same invention at an earlier date. The same overlapping of patents may similarly arise in the case of patents whose date is taken from the application for protection in a foreign country. In fact the author recommends that before making any contract to acquire a patent, an intending purchaser should make a search for other similar and *prior* inventions disclosed in specifications for a period of two years after the date of the application for the patent in question. Altogether, we think that Mr. Roberts has succeeded in compressing into 100 pages of excellently printed matter a most readable and useful summary of patent law as it appeals to the inventor.

Of quite a different character from the above is the volume which bears the signature of Mr. Reginald Haddan, a member of the well-known firm of patent agents of the same name. The problem with which the patent agent is called upon to deal is much more general in its scope than that of the learned barrister whose main concern is with the legal aspects of the question. The patent agent must of necessity be well-informed concerning many of the more commercial aspects of patent procedure. We accordingly find that a large amount of space is devoted by Mr. Haddan to the marketable properties of a patent and its negotiable value. On the question of validity the legal aspect is naturally the one which dominates the whole position. In Mr. Haddan's book we find an immense number of practical illustrations, culled, no doubt, from the practical experience which arises from daily contact with important manufacturing concerns, to whom it is a matter of urgent importance to secure the exclusive benefit of their discoveries. When we take the life-history of a patent from the time of its first inception, and trace it through all the possible incidents of its career, we find that it is subject to as many dangers and complications as the human infant. Each stage of its career must be carefully schemed out in advance, and the particular attacks to which it is subject must be well understood in order that it may be preserved intact throughout its natural life.

When we come to foreign patent law we find a further enormous field for the exercise of painstaking research and inquiry. To us, however, the interest of foreign patent law consists in the fact that we alone amongst important manufacturing nations appear to grant full protection to foreign applicants without asking for any *quid pro quo*. Why, for instance, we should allow a German firm to patent an invention in this country, and ourselves engage not to use it during its entire life, passes comprehension. We prevent our own manufacturers from using the idea, and thus give to our foreign rivals a complete monopoly without conferring any benefit on ourselves beyond the patent fees. The Englishman who protects his invention in Germany is treated on a very different footing. We read that a German patent can be revoked after the lapse of three years, counting from the day on which the patent is advertised as granted, (*a*) if the patentee does not work his patent to an adequate extent in the German Empire, and (*b*) if the patentee refuses the grant of licences when the same would be to the public interest.

It has been held that this provision is intended for the benefit of German trade and manufacturers generally, so that importation will not serve instead. The absence of such a regulation in the English patent law produces the most serious injustice to manufacturers and others. There is, however, no more a remedy for this evil than for the even greater one by which we are prevented from using the inventions of our foreign rivals, all the while that our own patents taken out in foreign countries are invalidated, unless we transfer to our rivals in these countries the right to manufacture under them.

* *The Inventor's Guide to Patent Law and the New Practice*. By James Roberts, M.A., LL.B. Published by John Murray, Albemarle Street, W. Price 2s. 6d. net.

* *The Inventor's Advisor and* (here follow the remaining 75 words of the title of the book). By Reginald Haddan. Sixth Edition. 1905. Published by Harrison & Sons, London. Price 5s.

THE HOUSE OF LORDS ON THE NEW SERVICE RIFLE.

LORD TWEEDMOUTH rose on the 24th ult. to call the attention of the assembled lords to the new service rifle, and he proposed as a resolution "That in the opinion of this House whatever convenience a shortened rifle may afford to mounted troops it is inexpedient that the whole of his Majesty's forces should be armed with the recently approved short rifle." He was convinced that a grave and costly blunder was about to be perpetrated, and he was anxious that the War Office should hold their hand before they finally adopted this weapon. He wished to impress upon their lordships the fact that it was not proposed to introduce what was really a new rifle. To all intents and purposes the War Office were simply going to continue the old rifle with a shorter barrel.

THE STRONGEST ARGUMENT

against the present type of British rifle was the fact that no other nation had adopted it—those nations who had not made inventions of their own preferring a rifle of the Mannlicher or Mauser pattern, or one approaching to one or the other type. In this they were at one with British marksmen and sportsmen. This bore out his theory that the action of the British rifle could be improved: the magazine was clumsy, it held ten cartridges, but to fill it the charger must be used twice. If they were going to spend a large sum of money on a new rifle they ought to consider whether the rifle could not be improved in stock, action, and magazine, instead of turning out the same weapon only with a shorter barrel. The whole of the weight saved by shortening the barrel was six ounces. The greater portion of the lightening had been secured by totally different means. He disputed the claim that the new rifle was an extremely good weapon for "snap" shooting, and characterised the sighting as extremely bad, inasmuch as by reducing the length of the barrel the foresight and backsight were brought so close together as infinitely to increase the difficulty of shooting. It was claimed that the rifle had

BALLISTIC QUALITIES

equal to those of the rifle it was replacing. That, it seemed to him, was alone a sufficient condemnation of its adoption for the whole of the Army. Why should we stick to results which were attained 14 years ago? The velocity of the old rifle and the velocity retained in the new rifle were, in round numbers, 2,000 ft. per sec. But our rivals in other countries were attaining velocities far exceeding this amount. Before we adopted a new rifle for our whole army, we ought to conduct all experiments to see whether we, too, could not get these high velocities. He put the ballistic qualities of a perfect rifle for military purposes under four heads:—(1) flat trajectory, (2) long range, (3) high striking power, and (4) accuracy. Effectiveness at extreme ranges was of great importance, not because we could hope for accurate shooting at such a distance, but because it compelled an enemy to deploy sooner than they would otherwise.

He wished to know something about the trial of this new rifle in competition with French, German and Italian rifles, and with the old long rifle. He wished to know whether these rifles were fired from

FIXED RESTS;

with what sights the rifles were provided; whether the new British sights were fixed to all the rifles, so that they were all used in similar conditions, and whether a trial was made with what he might call an improved long rifle. If the trials were made from fixed rests, they lost much of their value, because the rifles should be tried from the shoulders of expert men, and in conditions such as would prevail in the field.

That brought him to a trial that was reported in *The Times* on February 20. It seemed to him to have been an extremely satisfactorily conducted trial by seven men who would be admitted to be capable and expert shots. The result of the trial was that the long barrel fitted with the wind-gauge sight came out first, the long barrel came second, and the new short rifle third. That was at ranges of 200, 600 and 800 yards.

THE CONCLUSION

at which these gentlemen arrived were that the new rifle was badly balanced, the weight being too much at the muzzle end; that far from being likely to prove a better snap-shooting arm, it would be easier to fire quickly with the long rifle at any given object; that the recoil was considerably heavier than in the long-barrelled rifle; that the accuracy of the rifle as a weapon of precision was appreciably diminished; and that as evening approached there was a great flash of flame from the short rifle.

LORD ROBERTS, after referring to the question of carrying a rifle on horse-back, mentioned Lord Tweedmouth's criticisms of the Lee-Metford rifle some 15 years ago. He said:—I trust that the noble lord will excuse me if I express a hope that the objections he now raises to the shortened rifle may prove as groundless as those he pronounced against the introduction of the Lee-Metford rifle 15 years ago.

The Lee-Metford rifle was introduced in 1889. Six years afterwards the chief inspector of the Small Arms factory proposed that

A NEW PATTERN CARBINE

with bayonet should be prepared to supersede the long rifle on the grounds that, as the carbine then in the service fired the same ammunition as the rifle, was equal in accuracy, superior in handiness and portability, it would be a better arm than the rifle. The Army Board considered the proposal, and refused it on the ground that the length of the barrel was insufficient to ensure the entire combustion of the charge. In 1898 the question was revived, and the then Commander-in-Chief (Lord Wolseley) stated that he was not prepared to entertain any proposition for shortening the rifle, although he would much like to see it lightened. It was decided to try if this could be done, and the following arms were prepared:—(*a*) Service long rifle reduced in weight from 9 lb.—viz., to 8 lb. 5½ oz.; (*b*) service long rifle reduced in weight to 8 lb. 6 oz.; (*c*) a short rifle reduced in weight to 7 lb. 12½ oz.; and with the barrel shortened by 6¼ in.; (*d*) a short rifle the same length as the carbine, weight 8 lb 7 oz. These four rifles were submitted to the following committee:—Colonel Ian Hamilton (president), Colonel the Hon. F. Stopford, Colonel W. N. Lockyer, and Captain Lloyd (secretary). This committee was formed to consider and report upon the question as to the best practicable method of modifying the design of the present service magazine rifle so as to produce a

LIGHTER WEAPON.

Of these four arms the committee chose (*c*), namely, a short rifle reduced in weight to 7 lb 12 oz., and with the barrel shortened by 6¼ in., and asked for another similar to this one but still further lightened, for trial. Twelve of each pattern were ordered; but the outbreak of the South African war prevented the matter being further investigated, and nothing was done until the receipt of the following telegram from me, dated Pretoria, October 10, 1900, to the Secretary of State for War:—"As a large number of rifles will have to be made, I would suggest that they should be of the pattern recommended by the committee, of which Colonel Ian Hamilton was president, as I understand this rifle is about to be adopted for the native army in India. The new rifle must certainly be loaded on the clip system, and the only question is whether the calibre might not be advantageously still further reduced." A new Small Arms committee had, in the meantime, been formed and had taken up the question of improving the long service rifle. In their report, dated July, 1900, they raised the question, among others, whether, in preparing a new pattern of rifle, it should have a shorter barrel and longer bayonet in order to be suitable for all services. A decision on this point was postponed for my return from South Africa, and the committee continued experiments with a lighter form of long rifle with charger equipment and new sights. This rifle, together with one 5 ins. shorter, was submitted by the committee to the Director-General of Ordnance, who, in forwarding it to the Adjutant-General on January 8, 1901, minuted as follows:—

"EXPERIMENTS AT HYTHE

with the barrel shortened 6 ins. have shown that the shortened rifle shoots equally well up to 1,000 yards. Lord Roberts telegraphed from South Africa that future rifles should be with shortened barrels. At the same time there was a general feeling among the cavalry in South Africa that they were handicapped by having the carbine, which has a barrel 9 ins. shorter than the service rifle, and the Inspector-General of Cavalry asked for a longer carbine. It is hoped that the rifle now submitted will meet the requirements of both cavalry and infantry, and thus enable them both in future to be armed with the same weapon. Longer and shorter bayonets were also submitted." The Adjutant-General chose the short rifle and short bayonet, and I concurred in the choice on January 10, 1901. One thousand of the shortened rifles, as well as long and short bayonets, were then ordered for trial. This is the story of the shortened rifle up to the time it came to be selected as the one likely to prove most suitable for universal use in the army; provided that its efficiency in all respects passed the proof of exhaustive trials. These trials were carried out during 1901 under the following instructions:—(Then follows a voluminous statement of shooting trials under a great variety of conditions.)

In order to satisfy you that both in the construction of the shortened rifle and in the manner in which the trials were carried on, the officers concerned were in no way trammelled by orders from the War Office, I must ask your leave to read extracts from a letter I received a day or two ago from the officer who was commandant at Hythe, and a member of the

SMALL ARMS COMMITTEE

for the greater part of the time these duties were being carried out. Colonel Pennington writes :—

"The correspondence (*The Times*, February 3) pictures the "committee as a body oppressed by instructions from the War "Office which injuriously limited their field of action and tied "them to a narrow issue. This is incorrect and misleading. "During my first six months I was in doubt on certain points and "thought it my business to express my views to General "Brackenbury. General Brackenbury entirely convinced me that "we were dead on the right lines. Trials later on fully confirmed "this. The committee was in no way unreasonably tied down or "limited. It was asked to deal with the whole question in the "only manner which was practically possible. The committee "would most certainly have condemned the short barrel had it not "given complete satisfaction and had they not considered it an "improvement on the long barrel. The War Office is accused of "conducting trials with a view to suit a foregone conclusion. "This is almost too foolish to reply to. All trials were suggested "by me personally and were amplified by suggestions made by the "committee, who, being nervous about the short barrel, suggested "the widest possible trial. The scheme for trials was then "accepted by the War Office, not directed. My sole idea in "framing the Hythe and Army trials was to leave nothing undone "to discover defects. The Hythe Staff, as a body, commenced "trials with a bias in favour of the long barrel. I believe no trials "could be more thorough, more truly comparative, or more "practical. The committee could not have taken up the question "of a new type of rifle. It was urgent to deal with the defects in "our rifle which the war had brought to light, the chief one "being the absence of charger loading. The short barrel came "up in the connection and was eventually accepted on its "merits." During these trials

CERTAIN SHORTCOMINGS

were observed in the shortened rifle, and in December 12 more rifles, modified accordingly, were tested at Hythe in comparison with 12 Lee-Metford rifles. The commandant at Hythe reports that these trials were conducted with rigid impartiality, the short and long rifles being fired alternately so as to ensure absolutely similar conditions. These trials proved the shortened rifle to be equal to the service rifle in accuracy. As a further test, and to ascertain the opinion of infantry soldiers, it was decided to issue 1,000 shortened rifles to the army at home for trial, and on March 17, 1902, a programme for these trials was approved. The trials were carried out at Aldershot, Dover, Portsmouth, and Curragh, Dublin, and Cork by the various regiments stationed at those places, and in November of that year the Small Arms Committee reported that they did not regard any further trials as necessary, and that as a service weapon they considered the

SHORT RIFLE SUPERIOR

to the long rifle. It was on receipt of this decided opinion, given by the War Office's expert advisers, that I, as Commander-in-Chief, recommended to the Secretary of State for War that the shortened rifle should be introduced into the service to replace both the Lee-Metford rifle and the carbine. In July, 1903, reports were received from

SOMALILAND

that the short rifle which had been issued for trial in that expedition had stood the test well. It was said that "the men like it and shoot well with it." I have now explained to you the reasons of the proposed change, and I have enumerated the measures taken to enable us to arrive at a correct conclusion as to the fitness of the selected weapon for general use in the army. Up to the time of the recent appearance of the correspondence in *The Times* dealing with the deficiencies supposed to have been discovered in the new rifle, I had no idea that it had been thought to be in any degree faulty. Since the appearance of that correspondence I have used every effort to discover whether there are grounds for the objections brought forward by those who, for the most part, are experts as to the requirements of a match-shooting rifle rather than to those of a service weapon.

LORD KITCHENER,

to whom I telegraphed on the subject, replied :—"As far as I have been able to test it, the new rifle fulfils requirements. In my opinion, it is a better balanced, handier, as well as a lighter weapon, and more suitable for a man on the Indian frontier than the long rifle." And yesterday this further telegram was received from Lord Kitchener :—"The 7th Division at Meerut has been practising with the new rifle since the 11th, and all ranks speak highly of it."

This testimony, so far as it goes, is satisfactory ; but in view of the doubts that have been raised in the minds of the public and army as to the value of the new weapon, and as it is essential that our soldiers should not be required to take the field armed with a rifle in which they do not entirely believe, and as I am at least as anxious as anyone can be that they should have the best rifle that can be procured, I most earnestly hope that his Majesty's Government will consent to such further tests as will definitely

SOLVE THE DOUBTS

which now exist. To this end, I would suggest that a certain number of civilians should shoot against a similar number of soldiers at Hythe, each party firing with the long and short rifle alternately up to a distance of, say, 2,000 yards, and also a certain number of rounds of snap shots at short ranges. The programme must, of course, be prepared so that the trial may be carried on, so far as is practicable, under service conditions, in order that the qualities claimed for a short and light rifle may be practically illustrated. This, I think, could not fail to enable the country to arrive at a definite conclusion as to whether the long or the short rifle is the best for military purposes.

LORD DONOUGHMORE, Under Secretary of State for War, speaking after Lord Errol and Lord Lonsdale, said that proposals for re-arming always brought into public notice, with considerable prominence, the views of two schools of thought. There was, first, the military opinion, which had its views as to what sort of weapon was required for the army ; and there was, secondly, the school which regarded the weapon chiefly from the

SPORTING POINT OF VIEW,

which, naturally, was the point of view from which it would be regarded by the majority of their lordships. Again, the second school had a wing consisting of those whom, with all respect, he should like to call target experts. Why was it that these two schools always quarrelled whenever re-arming was proposed? It was because their needs were divergent. They regarded the rifle entirely from different points of view The sportsman needed a rifle of supreme accuracy. It was not only necessary that he should hit his beast, but that he should hit his beast in the right place. Weight did not matter to the sportsman very much, because he employed a gillie to carry the rifle for him. Did it matter to him if the rifle was delicate? Not a bit. There was a comfortable gun-room with all modern appliances for cleaning it or repairing any damage it might meet with on the hillside. To the

TARGET EXPERT

also it was of primary importance that he should have an accurate weapon, for a few inches in a thousand yards might make all the difference between success and failure. A few extra pounds of weight did not matter to him, for he had only a few yards to walk from his comfortable tent to the firing point ; and it did not matter if the rifle were delicate, for he did not shoot in unpleasant weather. How different were the needs of the soldier. So long as the rifle was a good, accurate weapon, it was

GOOD ENOUGH FOR THE SOLDIER.

But to the soldier a single pound in weight in the rifle was of cardinal importance. He had to carry his rifle over long marches, sometimes over forced marches, in all temperatures and in all climates, and he had to carry a great many other things besides. Again, a delicate weapon was of no use to the soldier. The army needed a strong rifle that would stand knocking about, for its master, after all, was a robust practitioner. He needed a handy weapon for snap-shooting, for shooting at moving objects, and for hand-to-hand conflicts, which were not to be encountered on the plains at Bisley. Therefore, there were cardinal necessities, which never entered the heads of the sportsman or the target expert, that needed the tullest consideration in selecting a rifle for the army. In passing, he might say that our late foes in South Africa found the long rifle not quite so handy as they liked, for he believed many rifles were found which we had lost and they had taken for use, and almost invariably a great deal of the wood under the barrel was cut away. The only true test for the army was one made under

SERVICE CONDITIONS,

and on this he welcomed the support of Lord Roberts. We had such conditions in Somaliland, and the fact that there was there a practically unanimous view in favour of this rifle and against the old rifle, should surely be allowed to have considerable weight. His colleagues on the Army Council had no hesitation in saying

that this was the rifle they wanted. It was true that no foreign nation had adopted our rifle, but a foreign nation which had re-armed since we commenced re-arming had adopted not only a short rifle, but a shorter rifle than our new one—the Swiss—who were a nation of marksmen. The United States, too, in 1898, adopted a short rifle; it was true they were stopped, but that was not because they were dissatisfied with the rifle, but with the bayonet. He did not think the comparison between the long and short rifles which had been referred to was a fair one, but he had *data* of a number of further trials, 19 or 20, which had been recently carried out, in connection really with experiments on a different point. They had been carried out with a number of different bullets they had been recently experimenting with. The rifles were all new, very carefully selected, and six of one sort were pitted against six of the other. The long rifle with the present bullet, and 20 shot diagrams at 600 yards, gave a figure of merit of 9 1-3 in., the new short rifle 7 1-3, 2 in. in favour of the latter. The second trial gave 9 3-5 and 8 in. respectively, and the third 8⅔ in. and 8 2-3 in., the total result being 8 2-5 in. for the long rifle and 7 4-5 in. for the short, or 3-5 in. in favour of the latter. These trials definitely proved

THE SHORT RIFLE NOT WORSE THAN THE LONG.

With regard to the recoil, the Gunmakers' Association of London found that the recoil from the long rifle was 11·9 ft.-lbs. and from the short 13·4 ft.-lbs., a difference which the Association assured them was not a very serious thing. He admitted the flash with the present ammuniton, but it was not a very grave defect. However, he was glad to be able to inform their lordships that the War Office had for a long time been carrying out experiments with

M.D. CORDITE

which was being used in big guns, to see if they could adapt its use to small arms. Their experiments were already sufficiently satisfactory to enable him to say they had every hope that they would shortly be able to use M.D. cordite, with which there was no flash, for small arms. In the matter of velocity, the long rifle was 2,000 foot-seconds and the short rifle 2,030, a slight difference in favour of the short rifle. With the same bullet the trajectory was the same in the two rifles, but if anything with the short rifle it was a little flatter. As regarded range, both our rifles, were sighted to 2,800 yards. A few foreign rifles were over 2,200 yards, but none over 2,400 yards. It might interest the House to know that the Japanese rifle was sighted to 2,187 yards, and the Russian rifle to 2,096 yards.

THE PRESENT CONTRACTS

would a little more than supply the mounted troops. Long before those contracts ran out the War Office would have received the results of the extensive trials under service conditions which were now in progress, and, if modifications were found necessary, they would not hesitate to say so and to recommend their adoption. But with the reports that they had, and with the opinion of their military advisers they had no justification for doing what the noble lord, if his motion were agreed to, would make them do—namely, to stop existing contracts. He earnestly hoped their lordships would not take up the practically *non possumus* attitude suggested in the motion and absolutely refuse to allow any progress to be made with the re-arming of the army with the rifle which the army had chosen for itself.

The MARQUIS OF LANDSDOWNE, speaking on behalf of the Government, said no complaint could be made of the manner in which the interesting debate had been conducted. A difficult subject had been carefully handled, though at times the figures were a little confusing. If the motion were accepted and became operative it would greatly embarrass the proceedings of the War Office and would throw on the House the responsibility for dealing with the supply of rifles to the army. If, on the other hand, the motion, being carried, remained inoperative, the result would not be consistent with the

DIGNITY OF THE HOUSE.

He asked, therefore, whether they were really in a position to commit themselves to the very decided and conclusive opinion to which the noble lord invited them by the motion. Surely it was a question that could only be decided by experts? The Secretary of State for War had behind him a very great weight of expert authority, and there was on the other hand a considerable body of public and expert opinion holding a different view. He did not wish to underrate the importance of statements supported by evidence which had lately appeared in the public press and had been put forward by the noble lord opposite. How then was it possible for their lordship's House to take upon itself to decide when these doctors differed? No doubt upon some points they were perfectly competent to form an opinion; for example, no one would deny the importance of accuracy in shooting for a military rifle, though his noble friend was perfectly right when he urged that the subject should be considered not merely from the point of view of the sportsman or marksman. It was surely not unreasonable to say that, other things being equal, the lighter weapon was better? Again, they might take upon themselves to say that, other things being equal, there was an advantage in having one weapon for the whole army, and that one cartridge in use was better than having a variety. His noble friend did not underrate the importance of accuracy, and, indeed, seemed to put it higher than the noble lord who moved the motion, and who placed it last among the four essentials he enumerated. But his noble friend's statements, full and convincing as they were, had been met by direct challenge. What, then, was the

REASONABLE COURSE

for them to adopt? Surely it was that which his noble friend Lord Donoughmore suggested. No harm would be done in the meantime, and they might with a clear conscience proceed with the completion of the orders which were actually in existence. As to the conversion of the existing long rifle, none were at this moment in progress, and none were intended in the very near future. He therefore maintained that their lordships might safely leave the matter without committing themselves to a resolution so binding on the House and so absolutely uncompromising.

LORD TWEEDMOUTH declined to accept the offer of the Government in the absence of an undertaking that in the meantime no further rifles would be manufactured except for the cavalry. The motion was put to the House and thrown out by 33 votes out of 55.

Capt. Thomson's report on the explosion which occured at an ironmonger's shop at Newcastle Emlyn, Carmarthen, on the 25th. of November last, suggests that the most feasible cause of the explosion was the fall of some iron article. This may have produced the necessary spark which led to the subsequent ignition of the explosive contained in a safe. It seems that this receptacle contained at the time of the explosion about 12 to 15 lbs. of blasting powder in one bag, and 7 to 8lbs. of sporting powder in canisters. Captain Thompson concludes his report with exceptionally severe comment upon the neglect of duty by the local authorities in Newcastle Emlyn. It seems that the Explosives Act has there been allowed to become an absolute dead letter, with the result that the ironmongers openly sold powder without having registered the premises. The gun trade is so much interested in preserving the good name of nitro-powder as a safe substance under suitable conditions of storage, that it will heartily endorse the chief inspector's demand for more rigid adhesion to the Act in the future.

TRADE MARKS.

ADVERTISED. FEBRUARY 1—22, 1905.

264,424. An illustrated device consisting of an eagle or vulture standing with outspread wings on a hemisphere, upon which the words Braun and Bloem, in Dusseldorf, are written. To apply to cartridges other than pin-fire cartridges and central-fire revolver cartridges. Braun and Bloem, Germany. June 20, 1904.

268,548. The word SAMSONITE. To apply to explosive substances. Nobel's Explosives Co., Ld., Glasgow. December 22, 1904.

268,875. The well-known Schultze trade mark, beneath which is is printed the word WESTMINSTER. To apply to cartridges. The Schultze Gunpowder Co., Ld., London. December 28, 1904.

No Trade Marks of interest to our readers appeared among the registrations during last month.

APPLICATIONS FOR PATENTS.

JANUARY 23—FEBRUARY 18, 1905.

21,504A. Torpedoes. J. Barr. (Date of application under Patents Rule 9, October 7, 1904.)
1,242. Rifle Sights. T Cuthbert.
1,356. Hardening Projectiles. H. Stanbridge.
1,389. Small-arm Sights. E. H. Parsons and L. B. Daylor.
1,415. Explosives. E. Hesketh and F. A. Willcox.
1,416. Explosives. E. Hesketh and F. A. Willcox.
1,505.* Small-arms. E. Sanner.
1,664.* Range Finder. H. Wild. (Date of application in Switzerland, February 1, 1904.)
1,807.* Ordnance Sighting. Fried Krupp, Ag. (Date of application in Germany March 12, 1904).
1,899.* Gun Cleaner F. T. F. Wilson.
1,940. Explosive. M. G. H. Gribble.
2,144. Small-arm Sights. A. A. Bonehill.
2,210. Target. P. Pankes.
2,269. Projectiles. W. Leddan.
2,417.* Ordnance Ammunition Case. Fried. Krupp, Ag. (Date of application in Germany March 16, 1904).
2,484. Aiming Drill. E. C. Kaufmann.
2,510. Detecting Fire-damp. J. McCutcheon.
2,523 Targets. A C. Fawcett.
2,730. Automatic Fire-arms. H. F. Woodgate.
2,776.* Nitroglycerin Centralsterre Für Wissenchaftlich Technicshe-Unlersuelhasgen G m. b. H. (Date of application in Germany February 12, 1904).
2,945.* Explosives. L. Barthêlam.
2,983. Case Shot Projectile. O. J. L. W. Beckmann.
2,992. Ammunition. W. Hunt (Agent for *L. Meston-Davies*).
3,024. Targets. A. Beedham.
3,033. Ordnance Projectiles. H. Stanbridge.
3,181.* Cartridge Cases. Rheinische Metallwaaren-und-Mf. (Date of application in Germany December 16, 1904).
3,338.* Ordnance. Fried. Krupp, Ag. (Date of application in Germany March 24, 1904).
3,426. Explosives. W. K. L. Dickson.
3,429.* Small-arm Projectiles. Deutsche Waffen-und-Munitions-Fabriken. (Date of application in Germany February 20, 1904).

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

JANUARY 26, 1905—FEBRUARY 23, 1905.

COMPILED BY HENRY TARRANT.

2,911 (1904). **Ordnance Sighting Apparatus.** A. T. Dawson and G. T. Buckham, London. Sighting apparatus of the kind described in Patent No. 24,703, 1903, in which large graduated drums are used for recording the range and deflection, is modified so as to neutralise the back-lash of the large dials and of the deflection screw; to provide an improved form of deflection indicator, and to provide means for adjusting the cross-rods employed for giving to the two sets of sighting apparatus their simultaneous elevation and deflection. Accepted January 5, 1905.

2,919 (1904). **Field Gun Carriages.** A. T. Dawson and G. T. Buckham, London. A field gun carriage in which the gear for elevating, traversing, ranging and sighting the gun is as far as possible enclosed so as to protect it. The elevating and ranging screws are located within the trail and are connected with arms forming part of the gun cradle and the sight-bracket. The traversing gear is enclosed in a casing connected with the top carriage and trail. The sight proper is rigidly fixed so as to minimise back-lash. Accepted January 12, 1905.

3,971 (1904). **Military Rifle Carrier.** Lt.-Col. J. H. Patterson, D.S.O., Colchester. A rifle carrier consisting of a loop and strap suspended from the mounted man's belt. A spring clip is attached to the saddle so that when the rider is mounted he is relieved of the weight of the weapon which is inserted in the clip. When dismounted the rifle hangs on the back and leaves the hands free. Accepted January 5, 1905.

4,536 (1904). **Ordnance Breech Mechanism.** W. Beardmore, G. A. Kohlen, and A. E. Mascall, Glasgow. Improvements in that type of ordnance mechanism which is moved into or out of position by one continuous movement of the operating lever An improved cartridge extracting device is also dealt with. Accepted January 26, 1905.

5,332 (1904). **Movable Targets.** W. F. Brisland, Hereford. A slide carrying a target is adapted to work in a slot cut in a hollow tube. The movement of the target is governed by a flexible cord running through the tube. The tube is capable of a rotary movement, through which movement the target is caused to disappear. Accepted February 2, 1905.

6,105 (1904). **Gun Cases.** E. P. and H. W. Lawrence and J. Row, London. A method of strengthening the construction of gun cases of the "leg of mutton type," consisting in building up a skeleton of thin pieces of wood steam-heated and pressed to the shape of the case. The wood foundation so formed is covered with leather. Accepted January 12, 1905.

6,178 (1904). **Rifle Back-Sight.** J. E. Rivsey, London. A back-sight for rifles in which elevation of the sighting aperture is obtained by a movement of a long link pivoted to a shorter link. The shorter link is pivoted to the movable bar whilst one end of the longer link is pivoted to a fixed part of the sight. The sight is capable of adjustment also to allow for wind. Accepted January 19, 1905.

7,307 (1904). **Sight Adjusting Device.** Professor Forbes, F.R.S., London. A device for adjusting the line of sight so that it shall be parallel with the axis of the bore when the barrel has no elevation. A tube is centrally fixed in the muzzle, and a light is caused to shine down the bore. The light is reflected through a lens of the same focal length as the length of the bore by two prisms arranged at either end of a tube at right angles to the tube in the bore. The sights are directed accurately to the point of light from the prism at the top of the second tube. Accepted January 26, 1905.

9,643 (1904). **Orthoptic for Use when Sighting.** H. McKenzie, Radnor Park, and W. Tivendale, Clydebank. Attached to a spectacle frame of the usual type is an eyepiece of an orthoptic. It is attached in such a manner, through the medium of two pivoted blocks held by two screws at right angles one to the other, as to be capable of easy and quick adjustment to any position suitable to the eye of the user. The disc of the orthoptic may also be quickly adjusted and is provided with a part to subdue the light. Accepted January 26, 1905.

13,738 (1904). **Ordnance Breech Mechanism.** A. Reichwald, London (Agent for *Fried. Krupp, Germany*). Means are provided for opening and closing wedge breech mechanism of barrel recoil ordnance, through which part of the energy of recoil is utilised to close the gun and so to lessen the load on the running out gear. A catch is automatically caused to hold a spring in the compressed state after the spring has been compressed by the recoil movement. The spring is released so that it helps in running out the gun. Accepted January 26, 1905.

18,751 (1904). **Automatic Shot Gun.** H. H. Lake, London (Agent for *The Winchester Rep. Arms Co., U.S.A.*). Automatic mechanism of a take-down shot gun is described in this lengthy patent. The parts have been combined with an idea of rendering the complete arm safe, light and simple. It takes the form of the usual Winchester, and barrels may be easily interchanged. Accepted January 26, 1905.

20,977 (1904). **High-Angle Ordnance.** A. J. Boult, London (Agent for *Fahrzeugfabrik Eisenbach, Germany*). Disengaging gear of the elevating mechanism for high-angle firing ordnance, differing from the ordinary type inasmuch as that the connection with the elevating machine is interrupted during the raising of the gun. The spindle of the machine is constructed in one piece. Accepted February 2, 1905.

23,368 (1904). **Machine Gun Mechanism.** P. M. Justice, London (Agent for *The Driggs-Seabury Ordnance Co., U.S.A.*). Automatic mechanism for small-calibre ordnance of the machine gun type is set out in a bulky specification.

The parts are arranged so that they may be assembled or taken apart by an unskilled operator without the aid of tools; and they are built heavy and strong to stand rough usage. Accepted January 12, 1905.

23,973* (1904). **An Explosive Compound.** J. C. Mitchell, U.S.A.

25,987 (1904). **Expelling Gases from Guns.** J. D. Edwards and C. C. Love, U.S.A. An automatic blowing apparatus adapted to expel the gases from a gun barrel after discharge but before the breech is opened. The recoil and return movements of the barrel operate piston rods and valves in two cylinders, one situated above and the other below the barrel. Accepted January 19, 1905.

26,050* (1904). **The Beesley Modified Single-Trigger Mechanism.** F. Beesley, London.

27,162 (1904). **Safety in Explosive Manufacture.** C. A. Allison, London (Agent for *A. Muller-Jacobs, U.S.A.*). Ordinary cloth is passed through a mixture of one part of nitric acid to three parts of sulphuric acid, and after pressing and drying is again passed through a non-acidulous bath of dilute caustic alkali. When this process is completed the explosive cloth is rendered more or less powerful by printing on one or both sides, in the same fashion as textile fabrics are printed and dyed, with appropriate chemicals and a suitable adhesive. Accepted January 26, 1905.

27,166 (1904). **Chlorate Explosives.** L. Lheure, France. The manufacture of chlorate explosives on a large scale is attended with an amount of danger. The patentee claims to obviate this drawback by pouring powdered chlorate of potassium or sodium into melted paraffin and afterwards stirring until the compound acquires the appearance of mortar. The proportion is roughly 90 per cent. chlorate to 10 per cent. paraffin. The explosive so formed can only be exploded by means of a detonator. Accepted January 26, 1905.

27,167* (1904). **Manufacture of Detonating Tubes.** L. Lheure, France.

27,178 1904). **Spirit Level Attachment for Ordnance.** Fried. Krupp, Ag., Germany. A spirit level is arranged so as to be capable of assuming at least two angular positions relatively to the attachment bar and independently of the adjusting device provided for the elimination of the angle of site. The level allows of the use of the attachment beyond those elevations which can be determined by drawing out the attachment, at the same time allowing of the elimination of the angle of site. Accepted January 19, 1905.

27,912 (1904). **Rifle Cartridge Cases.** H. W. Holland, London. Cartridges of the type possessing a flange at the base, of the same diameter as the body of the case, have been found to misfire owing to the bottle neck allowing the cartridge to enter too far into the chamber. A projecting ridge is formed just in front of the sunk flange to engage the extractor. A corresponding shoulder is provided in the barrel chamber. Accepted January 26, 1905.

28,397 (1904). **Locking Device for Small Arms.** F. M. Deeming, U.S.A. A locking device designed "to prevent over-inquisitive persons, or others not authorised, from handling the gun with liability of doing harm to themselves or others, or of injuring the arm, or meddling with it to the annoyance of the owner." A hinged band surrounds the grip of the gun stock, two parts holding the hammer and trigger against any movement. The band is secured by a padlock. Accepted February 2, 1905.

28,781 (1904). **Cartridges for "Gallery" Use.** J. S. King and J. E. Bell, U.S.A. A cartridge for use in saloon galleries, consisting of an ordinary shell within which a powder charge enclosed in a nitrocellulose paper envelope is arranged. The bullet is seated on the top of this explosive tube. The explosive is ignited by this method with certainty, and the cases may be easily reloaded. Accepted February 2, 1905.

28,805 (1904). **Sighting Device.** G. B. Araldo and L. Barabino, Italy. A back sight with which, instead of an ordinary V bar, two truncated cones are employed. These cones are arranged so that there is a space between their smaller ends, and with this space the foresight and bull are made to coincide when sighting. Accepted February 2, 1905.

29,056* (1904). **Nitroglycerin Blasting Explosive.** G. Dittmar, U.S.A.

29,423 (1904). **Machine Gun Muzzle Attachments.** A. T. Dawson and J. Ramsey, London. The muzzle attachment of automatic guns with recoiling barrels which slide to and fro in a water jacket, is so modified that the carbonaceous deposit or fouling due to the escaping gases is overcome. By making the sleeve with large radial opening, the kinetic energy of the gases rather than their expansive force is utilised for actuating the barrel disc. Accepted February 2, 1905.

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* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

NITROGLYCERIN BLASTING COMPOUND.

29,056 (1904). G. Dittman, U.S.A. A blasting compound is described with a nitroglycerin basis, which is not effected by frost, and may, therefore, be used in winter without thawing. Nitroglycerin is heated to its boiling point (180 deg. C.), and such substances as paraffin, stearine resin, sealing wax, soap, etc., which may be rendered liquid at a much lower temperature, are adapted to enclose the particles of nitroglycerin, and so to form a protective coating. Moreover, when a carrier in liquid form is mixed with nitroglycerin it is more intimate than any mechanical mixture. The product so formed will explode in a frozen state, because the particles of nitroglycerin are so minute, that crystallisation cannot occur even at the lowest temperature of winter. An oxidising mixture, such as nitrate of potassium or ammonia, may be added while the mixture is in the liquid state. Sulphur may also be added, either by fusing with the paraffin or resin, or with the oxidant. In this way the components of black powder can be incorporated in the blasting compound. Any substance which melts at a temperature lower than 180 deg. C may be used as a carrier, but preferably one that does not dissolve in water should be employed.

An example of the explosive and the method of manufacture follows. To 50 pounds of paraffin or stearine and 25 pounds of resin, heated together till the mass is perfectly liquefied, are added 25 to 100 pounds of nitroglycerin. The mixture is constantly stirred until the whole is solidified. The product obtained is soft and plastic and may be easily kneaded. The hardness varies with the amount of resin used, or with the quantity of sulphur fused with the mixture before the addition of the nitroglycerin. It is preferable to heat the latter in a water bath to 50 or 60 deg. C. before it is allowed to run into the liquefied carrier, which should have a temperature of 110 to 150 deg. C. Accepted January 26, 1905.

A BLASTING EXPLOSIVE.

23,973 (1904). J. C. Mitchell, U.S.A. The patentee has discovered that the constituents of sandal wood soluble in alcohol have the property of preserving explosives composed of oxygen-yielding and carbonaceous materials from damage by moisture, and further, that the addition of sandal wood or its extract enhance the propulsive effect of the explosive.

Thirty parts of cane sugar and ten parts of milk sugar are mixed in an open vessel and are heated to about the boiling point of water. The heat is removed, and while still hot a paste is added composed of four parts of sandal wood and six parts of alcohol; or an extract is added made by the combination of six parts of alcohol, preferably 64·8 overproof, to four parts of sandal wood, distilled in an open vessel until an extract having more or less the consistence of a thick oil is formed. After the mixture so formed has stood for about ten minutes, 50 parts of potassium chlorate are added, and the whole is stirred until the constituents are thoroughly mixed, and afterwards dried to allow of granulation.

An equivalent quantity of another suitable chlorate may be substituted for the potassium chlorate, and an equivalent quantity of another suitable carbo-hydrate for the sugars. The effect which the patentee desires to obtain is secured also by adding the constituents of sandal wood soluble in alcohol (not necessarily separate from other parts of the wood) to other explosive mixtures of carbonaceous and oxygen-yielding material. The term "constituents of sandal wood soluble in alcohol" is employed to define exactly that part of sandal wood which is essential to the invention Alcohol need not necessarily be used. Accepted January 26, 1905.

DETONATING TUBES.

27,167 (1904). L. Lheure, France. The manufacture of detonating tubes for use in blasting operations is dealt with in this specification. The filling of these tubes with explosives of small density presents difficulties, but such difficulties it is claimed are overcome by the substitution of either trinitrotoluene or trinitrobenzine for the explosives usually employed.

A tube of lead or tin of suitable internal diameter is filled with melted trinitrotoluene, and when the explosive has cooled sufficiently the tube is reduced to the final diameter desired by successive drawing operations in a rolling mill. The tube so obtained possesses the property of exploding under the action of a detonator of 1·50 grains of fulminate of mercury and of transmitting the explosion with the velocities of 5,000 and 6,000 metres per second. This property is retained even with small diameters. The tubes have been formed as small as two millimetres external diameter, making in effect detonating wires, in which the velocity of explosion has been about 4,000 metres. These wires may be given a sufficient mechanical strength by surrounding them with a plaited sheathing analogous to that of the matches used for mines.

The various ordinary methods of ignition, bar the fulminate detonator, are without action on the tubes of trinitrotoluene. In a lighted fire the tubes burn slowly, and they are therefore capable of being handled with safety. Accepted January 26, 1905.

THE "BEESLEY" MODIFIED SINGLE-TRIGGER MECHANISM.

26,050 (1904). F. Beesley, London. A modified and improved form of the single-trigger system previously dealt with in patents Nos. 26,749, 1898, and 8,139, 1903, by the above patentee, is set out in the present specification. A method of arranging the mechanism for discharge of the two barrels in either order is described, the backward or forward movement of the safety slide being adapted to direct either arm of a bifurcated limb to a position beneath whichever sear governs the barrel it is desired to be first discharged.

The mechanism is substantially of the same construction as that already well known, and from the drawings reproduced it will be seen that the slotted cam quadrant *a* is arranged to work between the trigger blade *b* and the supplementary blade *c*. The blade *b* and lever *c* are connected by the key *e* which passes through the circular slot in the quadrant *a*. The last-named part is pivoted to the trigger plate at *f*, and the spring *g* is so arranged as to tend always to turn the quadrant backwards—towards the back of the gun. When the gun is broken down for reloading, the lever *h* acts below the pivot *f* and turns the quadrant, against the pressure of the spring *g*, to the position illustrated in Fig. 1. The key *e* engages the recess *i* in the circular slot and holds the quadrant in this position.

Pivoted above the trigger blade at *j* is the bifurcated limb *k*, which in the manner to be explained may have either of its arms *l* or *n* carried beneath the right or left-hand sear respectively. When the trigger is raised the arm *l* lifts the right-hand sear if the arm is in that position, and so discharges the corresponding barrel.

The raising of the trigger disengages the key *e* from the slot *i* and allows the spring *g* to turn the quadrant forward to the position shown in Figs. 2 and 3. During its turning movement the involuntary pull due to the first recoil jars the key *e* up against the top of the circular slot before the quadrant has completed its movement, and so prevents the trigger moving far enough upward to disengage the left-hand sear from bent. When settled in its final position the slot *o* in the quadrant slot is presented just above the key *e*, allowing

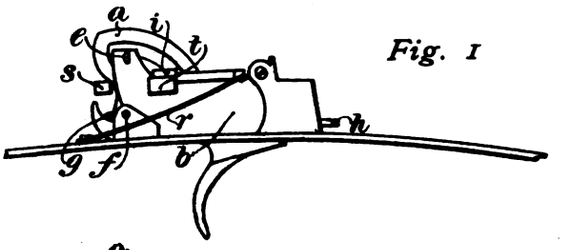


Fig. 1

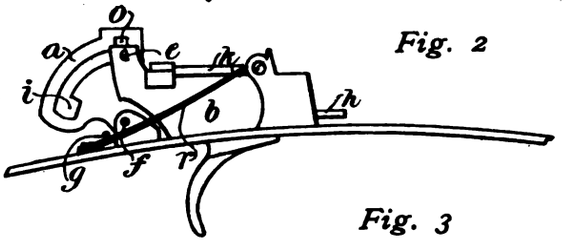


Fig. 2

Fig. 3

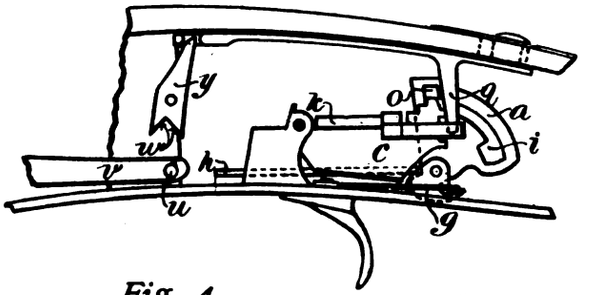
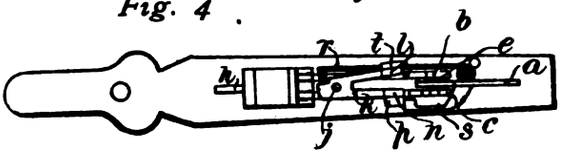


Fig. 4



the trigger blade to be lifted far enough for the step *p* to reach the sear and discharge the left-hand barrel when next the trigger is pulled.

The position of the bifurcated arm *k* is governed by the leg *q* of the safety slide. When the slide is pushed forward in the usual manner to release the trigger, the arm *k* is held by the trigger spring *r* in the position with the arm *l* beneath the right-hand sear. But if, instead of pushing the slide forward, it is pulled backwards (an elongated slot allowing of this movement), the trigger is released and the leg *q* engages the tail *s* of the arm *k* and turns the part *j* to a location beneath the left-hand sear. The process of firing is similar to that described above, except that the left-hand barrel is first discharged. The step *t* follows up to lift the right-hand sear.

The safety slide is automatically returned to its "safe" position by the projection *u* on the cocking dog *v*. When the dog is raised by the breaking down of the gun the projection *u* engages either of the inclined faces *x* on the lever *y*, and brings the slide to the "safe," no matter whether it had been pushed forwards or pulled backwards. Accepted January 5, 1905.

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CONTENTS.

CURRENT TOPICS.

Newspaper Rifle Trials.—The carrying out of a series of rifle tests by the *County Gentleman* has added another phase to the question of the merits and demerits of the new service pattern of rifle. While our contemporary deserves unstinted praise for its efforts to settle the various points in dispute, experts have not failed to point out that the scope of such experiments is necessarily so limited as to exclude the possibility of arriving at any final conclusion. To draw any real distinction between two types of rifle, both firing the same cartridge and imparting the same velocity to the bullet involves the firing of an immense number of shots with carefully selected examples of each rifle. Firing from a fixed rest necessarily introduces a number of complex disturbing factors which in the nature of things mask the conclusions that are sought. More than this, it is difficult to arrive at a clear understanding of the relative efficiency of two military weapons by the somewhat artificial conditions provided by the fixed rest. Although a certain number of diagrams were obtained with the rifles used in the experiments, there was no such marked difference between them as to indicate superiority on one side or the other. In fact, the more we enquire into the difficulties of arriving at the true state of affairs from this class of experiment the more certain are we that the best test for any class of weapon would be to fit a certain number of samples of it with match sights, and to place these weapons in the hands of a selection of long range marksmen. Each might then conduct an exhaustive series of shooting tests and report the results to a committee selected from their number, who would co-ordinate into a general report the various individual opinions that have been expressed. In this way we should comply with the fundamental need for obtaining a general average.

The New Short Rifle.—Nothing of any very great importance has transpired during the past month with reference to the new short rifle, unless, perhaps, as regards the patents for its construction. It appears that, until the amount of royalty to be paid to Mr. Joseph Speed, of the Enfield factory, for the use of his patents has been settled, rifles cannot be supplied to the private individual. Our own columns have borne witness to the fact that Mr. Speed took out a patent for the sight on the new rifle, though it passes our comprehension to appreciate the existence of adequate subject matter for a patent on such a simple line of research. There is not the slightest reason why the Government should not have adopted a perfectly suitable device free of such claims. However, when we entrust the design of a new service pattern of weapon to a committee of officers without mechanical or technical knowledge, it is only to be expected that they should seek to cover their own deficiences by obtaining advice from such men as Mr. Speed. His advice is given quite freely, and with the resources of Enfield at his disposal it would be strange if he failed to give them something approaching what they want. In due course he patents the mechanical combination which he has evolved, and as nobody commercially interested in such patents is likely to contest the patent, it stands for what it is worth on the official records. The Government probably enjoys the free use of the idea, or else it votes a gratuity to cover its use. When it comes to the supply of these rifles to private individuals, the happy inventor is in a position to state what are his terms. That is to say, the rifles so supplied

must be of Government pattern. Therefore the use of the inventor's discovery is involved, and a royalty must be paid so long as the patent device is used. This state of affairs produced such trouble in the case of the old rifle, that its repetition should have been avoided by arranging that any payment for patents should cover not only their use for the Government service but for all rifles to whomsoever supplied. Lord Tweedmouth made a great point in his House of Lords speech that the Lee-Enfield rifle was obviously bad because it had not been adopted by a single foreign government. In point of fact, if it had been in every way as fine a rifle as the German Mauser, the heavy royalties which had to be paid to the Lee Syndicate would have put it out of the running. With the Government supplying service rifles to clubs and other similar organisations, it is doubly unjust to the private manufacturer that his own sales should be restricted by payments for patent rights, which a competent committee would have been able to avoid. This trouble will always exist until the Government adopts the policy of buying up the whole of the patent rights controlling any arm which it may seal as of service pattern.

The Exeter Miniature Bisley.—The programme of the miniature Bisley promoted at Exeter by the National Rifle Association has just come to hand. It shows that the shooting will be mostly confined to service rifles, and as the conditions authorise the use of adapter ammunition of the Trask type, it is likely that some extraordinarily high scoring will be produced. The Morris tube cartridge, for reasons of calibre alone, would be absolutely incapable of meeting on level terms the more powerful ammunition as fired from the ordinary unreduced ·303 barrel. Miniature rifles are accorded a show in three unlimited entry sixpenny sweepstake competitions, but the ·22-bore rifle is unlikely to be used in these competitions, because it could not stand up against such rifles as the service, the Greener, and the Sherwood firing powerful large-calibre ammunition. As the whole of the shooting is conducted at 25 yards, the meeting seems to set the fashion of using more powerful ammunition than the conditions demand. Strictly speaking, the rifles to be used at this meeting, although called "service" are not such as would be permissible for use in S.R. competitions at Bisley. That is to say, the shooter may take advantage of the rule which allows a trigger pull of not less than 4 lbs. This condition is a little difficult to fulfil, since although it is easy enough to comply with the rules by using a 7 lb. pull, the shooter who takes the trouble to bring his rifle down to 4 lbs. will spoil it for other work. The strength of the trigger spring is such as to account for 4 lbs. of the pull, the remaining 3 lbs. being added by the friction between the sear and the firing pin. To bring the total pull down to an average of about 4¼ lbs. would thus necessitate the use of a spring at least 2 lbs. lighter than that ordinarily fitted. The meeting will take place over the four days ending the 15th inst.

The Sale of Guns.—The future prosperity of the gun trade is a frequent subject of thought amongst those who endeavour to pierce the mysteries of the future. The gunmaker, properly speaking, has always occupied a somewhat personal and privileged position with regard to his clients. His advice on all matters appertaining to guns and ammunition is received with respect and consideration; and although the turnover of the business has never been large, the profits have been sufficient to guarantee a competence to the painstaking worker who keeps abreast with the times. During the past ten or more years a very important section of his business has ceased to bring in revenue in proportion to the turnover. There are some dozen or so firms each of which makes strenuous efforts to monopolise the trade in cartridges. The increased turnover which follows from their endeavours naturally enables them to do business on a smaller proportional profit. This has operated against the gunmaker in two ways; first, by diminishing to a negligible quantity the profit on hand-loaded cartridges as filled in relatively small quantities; and second, by enabling ironmongers and other retailers of ammunition to sell thoroughly sound and effective cartridges at a very low price. This is rendered possible by the facilities which now exist for supplying the dealer with ready-made cartridges which he can sell without being called upon to understand anything about them. The gunmaker has hitherto been able to retain his position by reason of the skill and individuality which he exercises in the production of guns to suit his customers. In fact, there is good reason for believing that the difference between two equally good guns, one of which is specially selected and stocked to suit the purchaser, the other what may be called a rack arm, is so great that the gunmaker will always be in a position to hold his own in this respect.

The Need for Development.—The difficulties of maintaining a turnover in sporting guns on a level with that of past years has been emphasised by the slack financial conditions which have now prevailed for some time. Although shooting is probably a more popular sport than at any previous period, there are at the present time a vastly increased number of directions in which money can be spent. The motor car provides, for instance, a new means for emptying the well-filled purse, and so long as the new model of each year is so superior to that of the previous season, there will be a constant demand for new cars. When bicycling was a fashionable pursuit, a new machine was purchased each season to enable the owner to demonstrate his appreciation of the latest improvements. Bicycle types have now settled down to a well established level, with the result that interest in new designs has so far slacked that a machine is not discarded until it becomes unserviceable. This will no doubt happen to a modified extent to the motor car as well, and this vehicle will then become one of the ordinary accessories of life instead of dominating all other considerations. The gun has of late years settled down into a state of detailed perfection which spells stagnation in the trade. The hammerless system was so superior to the older mechanism, that specimens of the latter were rendered obsolete. The ejector gun produced another new fashion with which everyone sought to keep pace. It was hoped at one time that the single trigger system would produce a further excuse for rendering old stock obsolete, but unfortunately the mechanical problems involved have proved too intricate to secure its all round use. Hence we find that the sole remaining inducement towards the purchase of new guns is the supplying of a weapon specially stocked, shaped and adjusted so as to increase the pleasure and success of the shooter. This, however, is not alone sufficient to stimulate great activity of business, since sales are mostly restricted to those whose guns have become unserviceable.

SELLING PISTOLS TO HOUSEHOLDERS.

IN common apparently with sundry other people we have fallen into a curious error in respect to the interpretation of a portion of the Pistols Act. Clause 3 contains the words "It shall be unlawful to sell . . . a pistol to any person unless . . . he gives reasonable proof . . . that, being a householder he purposes to use such pistol only in his own house or the curtilage thereof, or that he is about to proceed abroad for a period of not less than six months, and produces a statement to that effect signed by himself and by a police officer, etc." Now we assumed that the production of the police certificate applied equally, to the householder and the person going abroad; but as a matter of fact this is not so, and the obtaining of a police certificate is only necessary in the case of the latter class of purchaser A householder requires merely to give reasonable proof that he occupies that position, and practice has established it as sufficient proof if a printed form is suitably filled in. The vendor should presumably take the usual steps to identify the person whose signature appears on the printed form. Only lately we heard of an instance where a visitor to London desired to purchase a pistol, and the gunmaker took him to the police station to secure the necessary permit. The police officer refused to sign; and referred the customer "to the officer of the district within which he resides." Needless almost to say the sale was lost. A purchase can equally be effected by a person who selects a pistol on behalf of the householder who has filled in the form.

We thus see that the chief remaining difficulty of the new Act is the supplying of pistols to persons about to proceed abroad. The present regulations take far too little account of practical conditions, and for that matter human nature as well. The difficulty concerning the production of a licence could in many cases be met by conducting the sale on the householder basis. One or two minor easements are desirable by way of facilitating the sale of pistols which are required for blank firing, such as on the stage and for the starting of races. Another direction in which additional relief might be obtained would follow from the enterprise of such a firm as Messrs. Webley in bringing out a pistol with a barrel rather longer than the statutory nine inches. We have heard that private pistol practice has been greatly checked by the provisions of the Act. This should not be possible when such firms as Stevens regularly catalogue a variety of target pistols with a regular length of barrel of ten inches.

In fact when we carefully examine the provisions of this much abused piece of legislation we find that some of its most grievous aspects arise in a large measure from misinterpretation of phrases. Our definition of the true boundaries of the Pistols Act must not be regarded as unscrupulous encouragement of gunmakers to drive the proverbial coach and four through it. The cheap common pocket pistol which the weak-minded youth is ambitious to carry, without realising that his own safety is even more imperilled than that of others, is a most objectionable contrivance. Our endeavour is to show where legitimate sales can be affected in the presence of restrictions which are directed against the cheap and nasty pocket terror of the young hooligan. The Act has proved effective in this respect, and this fact must be recognised,

THE MINIATURE RIFLE DEFINED.

THE circular letter issued by the Society of Miniature Rifle Clubs, which we print in another column, represents a most statesmanlike judgment on a very difficult problem. Every word in the circular receives our most cordial endorsement, for we see in the policy there outlined a sound appreciation of the principles upon which rifle marksmanship is most likely to prosper. Skill with the rifle, however attained, is undoubtedly the personal attribute which the Society calls it. That is to say, if a man or a boy learns to shoot one sort of rifle he has acquired within his own personality certain powers which he will be able to apply to the shooting of any other kind of rifle. The Society realises in the most broad-minded manner that each club must be free to select the particular form of rifle, ammunition and sighting that best suits its environment and the character of its membership.

There is, however, one item in the circular which we should like to see expanded. While it very wisely admits every kind of sighting, bar magnifying glasses, telescopes or spirit levels, it does not differentiate with sufficient clearness between shooters using orthoptics and others using open sights. The advantage of the aperture backsight over the simpler form of open sight is so marked, that the Society should have made it clear that while it recognises both kinds of sight it frankly admits that the two cannot be used on an equal footing in competition with one another. Supposing, for instance, that the Society promotes a miniature Bisley on the lines of admitting both types of sight for all competitions the shooters using rifles fitted with open sights would labour at a serious disadvantage. Another point where the circular might have been made more explanatory is in regard to what is called the aiming spot. Personally, we feel sure that the size of the bulls-eye for every distance ought to be clearly stated. Recognising, for instance, as standard ranges 20, 25, 50 and 100 yards, the size of bull and marking rings for each of these should have been stated. To meet the case of clubs using ranges where it is inconvenient to shoot at any of these distances, it would have been useful to state the proportional size of bull and rings, for a variety of odd ranges, so as to render the optical conditions as nearly as possible uniform.

The National Rifle Association has hitherto displayed strange variations in respect to the size of target for different distances. At last year's miniature Bisley the 8-inch bull was used for 20 yards. This makes one inch the standard for 25 yards. The Frankfort competition at last year's Bisley meeting was shot over 20 and 25 yards, the bull diameters being 7-8ths and 1-inch respectively. The coming Exeter meeting will be held on a range of approximately 25 yards, and the size of bull will be 7-8ths of an inch. We do not oppose these changes in a spirit of conservatism pure and simple, but we should like to know once and for all how we stand in the matter of targets. The Morris Tube Company sells a target which it describes as the N.R.A. standard for 25 yards miniature range. This is probably used in large quantities, and yet the Exeter meeting introduces a materially different size. A ⅞-in. bull for 20 yards' shooting introduces conditions which are familiar to those engaging in Morris Tube practice, but the club shooter has been accustomed to the 1-in. size.

SHOT GUN DEVELOPMENTS.

In another portion of this issue we discuss the possibilities of the immediate future in the development of business in the sale of guns; and we arrive at the conclusion that there is no radical improvement in sight, such as affords promise of special stimulation of trade. In such circumstances it is interesting to consider some of the opportunities which occur in gun construction for making new weapons superior to those of the previous decade in the absence of radical changes of design. In furtherance of this idea we propose in the present article to consider the barrel from the point of view of its shooting properties, and its capacity to assist the shooter in the accomplishment of a satisfactory day's sport. If we look around and examine the condition of the barrels in a selection of typical guns in regular use we shall find remarkable evidences of an opening for improvement.

Hitherto the very best work in barrel manufacture has only been possible in weapons of the highest class; but now that the Birmingham Small Arms Company has taken up the manufacture of barrel tubes, we have evidence, from specimens of this company's output, that some of the most essential characteristics of first-class workmanship are incorporated into tubes which are sold at a price that enables them to be used in the cheapest guns that are made. This result has been attained by the adoption of the highest mechanical developments in boring, reaming, and straightening. In fact we may safely say that the B.S.A. method of turning out shot gun tubes is more advanced and in a greater state of perfection than is the case with any other factory in the entire world.

If the English gun trade could see their way to enter into a scheme of close collaboration with the Birmingham Company it would be possible to ensure an immediate enhancement of the shooting qualities of the English gun. Not only do we assert most emphatically that the inside boring of the tubes assists the final evolution of a perfect bore; but we go even further. The reduction of the outside of the barrel by the methods employed in the B.S.A. Factory ensure a greater degree of concentricity than can be obtained by ordinary methods at anything approaching the same manufacturing cost. Tenacity and quality of gun barrel steel are of entirely secondary importance to perfect concentricity of the inside and outside circumferences. In just the same way that the strength of a chain is determined by the weakest link, so the strength of a gun barrel is emphatically that of the thinnest part of its circumference at any place.

Perfect balance in a shot gun is mainly a matter of making the barrels light forward; and lightness, combined with strength, can only be secured in the presence of perfect workmanship of the kind which produces equality of thickness all round. If each maker made it a regular habit to sectionise a certain proportion of his output, say every barrel which is scrapped for one reason or or another, he would realise how seldom the perfect barrel is attained in practice. Thick and thin tubes which stand the test of wear serve to show how much lighter the same barrels could have been made could perfect concentricity inside and out be guaranteed. Now that the B.S.A. method of manufacture brings us so near to perfect concentricity in the single tube, the gunmaker can order his tubes closer than ever before to the size aimed at before assembling.

When the B.S.A. Company first started the manufacture of shot gun tubes they copied the dimensions which had hitherto been customary in the trade. But when it became apparent that the new barrels approached so near to perfection as regards straightness of bore and concentricity of circles, the gun trade immediately asked them to work closer than was ever before possible to the ultimate size. The barrels are seldom reduced more than a few thousandths of an inch after being assembled, most of the work put into the barrels being carried out before that stage. It has been the aim of the Birmingham Company to turn out barrel tubes virtually ready for the assembling process. This gives to the finished gun the whole of the benefit of the unexampled mechanical perfection of the new method of manufacture.

While the B.S.A. Company have devoted so much original thought to the manufacture of barrel tubes, on a principle that permits of selling them at a very low price, it must not be forgotten that the Webley Company have also an exceedingly carefully-organised barrel department where a large amount of first-class work is turned out. In just the same way that we may regard the B.S.A. Company as specialists on the tube, so we may see in Messrs. Webley's equipment the most perfected appliances for the true gunmaking processes of finish-boring and assemblage. No one realises more fully than this firm's experts how much the ultimate success of the shooting qualities of a gun depends upon the proper formation of the chamber, the cone, the bore, and the choke. Mr. Whiting has frequently insisted in our hearing that if the interior of a shot gun barrel is built true to shape, on sound mechanical principles, it is a virtual certainty that the shooting will be of the best. How far ordinary guns depart from this ideal must be seen to be appreciated. We do not thereby accuse anyone of incompetence, but what we do say is that our knowledge of barrel construction and its influence on the behaviour of a cartridge has so increased during very recent years as to show an important opening for future improvements.

The owner of a rough shoot who mistakenly uses an ill-bored cylinder for his right barrel and a full-choke for his left is handicapping himself very much against the user of a weapon giving improved cylinder shooting in both barrels. The perfect tube reduced to the greatest possible thinness of barrel wall, combined with a perfect bore and chamber, will produce a handiness of balance and a perfection of pellet distribution which will alone be sufficient to make the older specification of barrel obsolete. The class of shooter who still demands a figured barrel and cylinder and choke-boring must be educated out of his mistaken belief, and this process of education should carry with it the sale of many new guns. The educated shooter who enjoys the wealth and position that enable him to patronise the best make of gun has long ago discovered that improved cylinder boring is the most satisfactory for his class of sport. The man to whom driven game is almost unknown, thinks that the occasional long shots he is called upon to take require the presence of full choke in the left barrel. He unknowingly punishes his shooting in respect to 80 per cent. of the shots fired with the left barrel, with only an occasional brilliant success at long distances as compensation. We accordingly maintain that the most promising line of future development is in the direction of barrel manufacture on the most recently approved principles.

MINIATURE RIFLE SHOOTING.

THE Committee of the Society of Miniature Rifle Clubs arriving at the conclusions upon which the regulations, below given, are based, appreciate the fact that they are legislating for a new movement destined to assume immense proportions, and that circumstances, which have not yet arisen, may from time to time necessitate changes which cannot at present be provided for.

In the first place they wish to point out that the non-existence of sites near populous centres suitable for service rifle ranges, and the expense of service rifles and ammunition, offer an effective bar to any considerable use of service rifles by civilian rifle clubs, and that the education of our countrymen in the art of marksmanship can only be effected by means of low power and miniature rifles. Fifty-five per cent. of the civilian rifle clubs affiliated to the National Rifle Association and a great majority of those affiliated to the Society of Miniature Rifle Clubs already use miniature rifles with miniature ammunition at short ranges.

With regard to the military aspect, they are of opinion that a rifleman who has mastered the art of marksmanship with any rifle (miniature or otherwise) is fully qualified to enlist as an expert, and the fact that his skill may have been acquired with a non-military rifle under conditions having no similitude to those which obtain in warfare has little or no bearing except that it is favourable to his ultimate utility as a military rifleman.

They consider that marksmanship is a personal attribute and that the marksman's skill will be exactly proportioned to his ability and the excellence of his rifle and ammunition, without any regard to the means or conditions by which he has acquired it. They do not agree with the contention that marksmanship of any practical military value can only be acquired by means of the service rifle, and even assuming this view to be incorrect, as practising with the service rifle under war conditions is not at present possible for the masses, owing to the great expense involved they are sure that such skill as can be acquired under the conditions proposed, is better than none at all, which is the alternative that has to be faced. They are in favour therefore, of allowing the utmost elasticity as regards rifles, sights, and positions in shooting, believing that clubs may be safely trusted to ascertain that which is best suited to their local circumstances. They see no advantage in insisting that miniature rifles should resemble service rifles in weight, form or pattern, nor that any restriction should be created as regards sights.

Military sights are just now undergoing transition and no particular pattern has been universally adopted. Service conditions appear to necessitate some sacrifice of refinement and consequent accuracy of shooting in order to secure great strength and simplicity, and they are not prepared to say which of the numerous patterns in use in our service will be retained. They therefore propose to allow affiliated clubs every latitude, but have delayed in competitions under their rules the admission of telescopic and magnifying sights for the present.

They offer no objection to the use of aperture sights, as such are already to be found on the British and other Service rifles, and have clearly demonstrated their utility under all conditions under which rifles are used. The governing factor determining miniature rifle shooting being the cartridge, they have settled their definitions so as to include all the small cartridges now upon the market, with a small margin of charge and weight of projectile to cover possible improvements by ammunition manufacturers.

The remarkable efficiency, accuracy and cheapness of the ·22 calibre rim fire cartridge is in their opinion likely to bring it into universal use, and no inequality of conditions is likely to arise by the admission of any other ammunition coming within their definition. The ·22 calibre long-rifle cartridge containing 5 grains of gunpowder and 40 grains of lead fulfils all requirements of a perfect cartridge for all distances up to and including 100 yards, whilst not possessing any marked superiority over the ·22 short with its 3 grains of gunpowder and 30 grains of lead at 25 yards. As most rifles which will shoot the long rifle cartridge will shoot the short, whilst those constructed for the latter will not shoot the former, they think no restriction should be placed upon the club's choice of either.

They are not oblivious to the fact that a certain amount of rifle shooting is carried on at present with cartridges suitable for use in service rifles with adaptors containing a reduced charge. They recognize the amount of merit which is to be attached to such practice, but wish to point out that for instructional purposes, in the tuition and practice of rifle shooting, both for men and boys, this is not in their opinion as beneficial as the method herein recommended.

Where such ammunition and rifles are used, competitions had better be restricted to their use, and they should not be employed in matches against individuals using miniature rifles and ammunition as herein specified, for the difference in calibre (·303 against ·22) gives an unfair advantage to the former in scoring; it is obvious that in all match shooting an uniformity of conditions is an essential feature, whilst on the other hand they cannot too strongly emphasise the fact that interest in practice cannot be maintained unless competitions between individuals and more especially between rifle clubs are encouraged in every possible way.

The extreme length of a miniature range seems to have been determined by a number of circumstances. The rifle and ammunition proposed are capable of excellent results at 100 yards range, whilst any longer range necessitates the use of greater power in the ammunition. One hundred yards is the practical limit of visual spotting by means of telescopes, without any assistance from markers at the butt. Any increase of range necessitates large targets and a corresponding increase of cost should come under the category of full power ranges. They see no necessity for differentiating between indoor and outdoor ranges, or of making any special provision for ranges under 25 yards in length.

The standardization of targets has been a difficult matter. The great accuracy of miniature rifles has rendered the common Bisley pattern target with scoring values from five to two inefficient for determining the comparative value of a number of scores by score alone. They find that this has necessitated the formulation of no less than five pages of rules relating to ties in the National Rifle Association regulations, most of which are easily avoided by adopting an increased number of measuring rings on the target and a

higher numerical value to each. The advantage of the figure 10 in facilitating calculations has caused them to recommend it as the unit of the highest score value. They have proposed targets of National Rifle Association dimensions in which the Society's nine, seven and three rings correspond with the N.R.A. bullseye, inner, and magpie—thus facilitating comparison of both methods of scoring—and permitting the use of the Society's target for the National Rifle Association rifleman's certificate test.

REGULATIONS.

1. MINIATURE RIFLE CLUBS.—A Miniature Rifle Club is a Club which, being affiliated to the SOCIETY OF MINIATURE RIFLE CLUBS, carries on rifle shooting wholly or partly with miniature rifles on miniature ranges with miniature ammunition, as defined in paragraphs 3 and 4.

2. MINIATURE RANGES.—A Miniature Range is a range not exceeding 100 yards in length, upon which miniature rifles and ammunition, as defined in paragraphs 3 and 4, are used.

3. RIFLES.—A Miniature Rifle may be of any pattern, single-loading or repeating, of any calibre not exceeding ·23 of one inch or 6 mm.; or, a rifle of larger calibre fitted with any device for firing miniature ammunition, as defined in paragraph 4. Sights may be of any pattern, fixed or adjustable, both vertically and laterally, but, in competitions promoted by the Society, rifles may not be fitted with magnifying glasses, telescopes, or spirit levels. A miniature pistol may be single-loading or repeating, with any sights as described for miniature rifles, and taking any miniature ammunition as defined in paragraph 4.

4. AMMUNITION.—A miniature cartridge may be rim fire or central fire, with projectile of any calibre not exceeding ·23 of one inch or 6 mm., and, in case of bottle-shaped cartridges, the shells may not exceed ·297 of one inch. The powder charge may not exceed 7 grains of black gunpowder, or its equivalent in any other explosive. The projectile must be of lead, not cased with other metal, and not exceeding 50 grains avoirdupois in weight.

5. TARGETS.—Targets shall be of penetrable material, preferably cardboard, printed or lithographed with black ink upon white paper of the following dimensions:—For shooting up to and including 25 yards, a card 6-inches square having 10 rings, the central being half-an-inch in diameter and increasing by half-inches to 5 inches. For 50 yards, a card 12-inches square having 10 rings, the central being 1-inch in diameter and increasing by 1 inch up to 10 inches. For 100 yards, a card 18-inches square having 10 rings, the central being 1¾-inches in diameter and increasing by 1¾ inches to 17½ inches.

6. SCORING.—The score value of the central ring shall be 10, and of the other rings in a descending scale 9—8—7—6—5—4—3—2—1.

7. AIMING SPOT.—Rings numbered 10, 9, and 8 may be blacked to form the aiming spot.

MEMORIALS DES POUDRES ET SALPÊTRES, TOME XII. *Paris: Published by Gauthier Villars*, 1903-1904.—The issue under notice is part 3 and 4 of Vol. XII., and completes that volume. It consists of the usual administrative reports and articles of a technical nature. The former gives some details on explosives for shells and fiery mines, as well as information regarding the behaviour of detonators. The articles of a more abstract nature contain, amongst others, "The loss in the transmission of power," and "The proof of blasting explosives." The present issue is made up of matters not only interesting to the explosive manufacturer but also to all readers of explosive literature, a feature which at all times has been characteristic of this publication of the French authorities.

COPPER PRESSURE TABLE.

WE give herewith a new table of pressure for use with the new conical copper of Col. Holden's design, which has recently been adopted for shot-gun tests. It works in connection with a piston area of one-twelfth of a square inch. It possesses all the characteristics of the ¼-in. by ⅛-in. in cylindrical copper, with the added advantages of greater range of action and more convenient size. It measures ·5 in. high with a top diameter of ·1-in. and a base diameter of ·25-in. The chief advantage of the new form of copper is that while it produces the most sensitive response to low values of pressure it is equally capable of recording the highest.

Remaining Length.	Pressure Tons per sq. in.	Remaining Length	Pressure Tons per sq. in.
·500	Nil.	2	3·02
·499	0·33	1	·06
8	·45	·450	3·10
7	·56	·449	·14
6	·66	8	·18
5	·75	7	·22
4	·84	6	·26
3	·92	5	·30
2	1·00	4	·34
1	·08	3	·38
·490	·15	2	·42
·489	·21	1	·46
8	·29	·440	·350
7	·35	·439	·54
6	·41	8	·58
5	·47	7	·63
4	1·53	6	·67
3	·59	5	·71
2	·65	4	·76
1	·70	3	·80
·480	·75	2	·84
·479	·80	1	·89
8	·85	·430	·93
7	·90	·429	3·97
6	1·95	8	4·02
5	2·00	5	4·15
4	·05	4	·19
3	·10	3	·23
2	·15	2	·28
1	·20	1	·32
·470	·25	·420	4·36
·469	·30	10	4·80
8	·35	·400	5·23
7	·40	·390	5·66
6	·45	80	6·10
5	2·50	70	6·56
4	·54	60	7·05
3	·58	50	7·55
2	·62	40	8·05
1	·66	30	8·65
·460	·70	20	9·15
·459	·74	10	9·75
8	·78	·300	10·35
7	·82	·290	11·05
6	·86	80	11·70
5	·90	70	12·40
4	·94	60	13·15
3	2·98	·250	13·95

ROUND THE TRADE.

Mr. J. T. Musgrave, of the Wilkinson Sword Co., Ld., sailed for the United States on the 18th ult.

We have been informed that Messrs. Woodward have decided to establish a shooting school at Croydon.

We regret that the works of the Pegamoid Company were injured by an explosion and fire which occurred on the 7th ult.

Mr. W. M. Thomas, of the Union Metallic Cartridge Company, of Bridgport, Conn., is now paying a visit to this country. His programme includes an extensive continental trip.

Discharges at Enfield seem to be proceeding at a very rapid rate, which is somewhat difficult to understand, except on the assumption that the production of the new rifle is being curtailed.

Mr. Ernest B. Winn, nephew and executor of the late Mr T. W. Webley, has been elected to a seat on the board of directors of the Webley Company, of which he is now chairman.

We are asked to mention that the Normal Powder Company have been appointed purveyors of Normal Powder cartridges to the King of Spain and the Crown Prince of Sweden and Norway.

We have received from Mr. A. G. Rickarby a neat little pocket guide to miniature club rifle shooting, in which he gives much useful advice to the embryo marksman. Mr. Rickaby is a member of the Ashford Rifle Club, whose doings have doubtless given him the practical insight he displays on the subject.

The Vickers-Maxim report informs the shareholders that the item standing as reserve has been written off against goodwill. After deduction of a further sum of £50,000 taken from the profits of 1904 goodwill and patents stand as a separate item at £637,456, or under 8 per cent. of the total assets of the company.

A meeting was called on the 31st ult. at one of the London hotels by Mr. Challoner, of Abbey Shot fame, the main object of which was to form an association for protecting the interests of the gun and allied trades. We were not represented at the meeting, but judging from the opinions which have been expressed, Mr. Challoner's self-appointed rôle of reformer seems unlikely to meet with much approval.

With reference to the use of War Department rifle ranges by civilian rifle clubs, the Director of Fortifications and Works has notified that the *minimum* charge of £5 per club yearly heretofore made will not be enforced in future, and and that payment will be required only at the rate of 1s. per annum for each club member, in addition to the charge for markers, &c., and for all damage other than fair wear and tear.

Mr. Arnold Foster, in answer to a question in the House of Commons, stated that orders for the new short rifle have been placed as follows:—New Rifle; British Small Arms Company, 70,000; London Small Arms Company, 35,000; Sparkbrook, 19,000; Enfield Lock, 98,000. Converted Rifle: Sparkbrook, 25,000; Enfield Lock, 39,500; 158,000 short rifles have already been manufactured, and 130,000 have been issued to date.

Mr. A. Tunstall contributed a letter to the *Birmingham Post* of the 6th ult. in which he congratulated the Guardians of the Birmingham Proof House upon the steady growth of the gunmaking school. Bearing in mind the attacks which were made upon this development in its early days, it is interesting to note that the good work it has accomplished is enabling it to live down the prejudice which was entertained against it by the gunworkers.

In the House of Commons on the 21st ult. it was mentioned that the contract price for the new short rifle in the current year is £4 11s. 8d., as against the ordnance factory price of £3 17s. If it were not for the doubtful aspects of the Government audit, we should be inclined to regard this as a proof of the efficiency of Government methods. Many manufacturers could show equally brilliant results if they were able to ignore invested capital and a large proportion of the expenses of administration.

Mr. W. H. Hughes presided at a very pleasant gathering of committee members of the Birmingham and Provincial Gunmakers' Association on the 15th ult. Among those who took advantage of Mr. Hughes's hospitable invitation were Messrs. T. Turner, A. Bonehill, J. C. Scott, R. J. Petersen, E. J. U. Turner, J. W. Ward, W. P. Jones, E. James, Joseph Rowlands (solicitor), and W. L. Powell. An excellent dinner was followed by a sociable evening, in which the opportunity was taken of toasting the success of the Association, coupled with the name of its most capable chairman.

Messrs. Lane Bros. have kindly forwarded for our information two recent copies of a new paper which is published in Birmingham in the interests of the working man and his recreation. The bulk of the paper is occupied with notes and reports concerning air-gun club matches. As most of the headquarters of these clubs are on licensed premises, we get some curious combinations in the list of fixtures, such as:—Hen and Chickens *v.* Bird-in-Hand; Falcon *v.* White Swan; Spotted Dog *v.* British Lion; John Bright *v.* Shakespeare; Dog and Partridge *v.* Peacock. When the Marquis of Lorne tries conclusion with the Hop Pole we trust that no injury will be done.

An Order in Council bearing date the 27th day of March, 1905, ordains that picric acid when in process of manufacture (for whatever purpose used or manufactured) be deemed to be an explosive within the meaning of the Explosives Act, subject to its exemption when mixed with not less than half its own weight of moisture. As regards its subsequent conveyance, storage and handling it shall similarly be deemed to be an explosive subject to the above proviso and to additional exemption for lots not exceeding 2,000 lbs., provided it is suitably protected from certain sources of danger. The Order clearly specifies the precautionary treatment that must be adopted, and it comes into force on the 1st inst.

We learn from Messrs. Hunter & Warren that the effects of the fire which occurred on their premises at 72, Waterloo Street, Glasgow, on the 8th ult., were much exaggerated. As a matter of fact, the Home Office Inspector anticipated finding half of Waterloo Street in ruins, but he saw not a trace of fire or explosion until he had passed through the front building. The fire certainly damaged the adjoining property, say, to the extent of £2,000 in all, but it was a fire, and not a disastrous explosion. Sporting ammunition was alone kept on the premises, the stock of explosives being divided over two registered premises some distance away. The disturbance of business has been exceedingly slight, and as nearly the whole of the damage is covered by insurance, Messrs. Hunter & Warren are to be congratulated on their satisfactory emergence from a somewhat severe ordeal.

The annual report and accounts of the Webley and Scott Revolver and Arms Company displays a very unfortunate falling off in profits, which is attributable to the diminution of turnover to a level that leaves very little margin after providing for establishment expenses. After making the usual ample provision for repairs, maintenance, depreciation and so forth, there remains a balance of £4,361. This, with the addition of the amount brought forward from the last account, has enabled the directors to pay the preference dividend and carry forward £1,401. At the general meeting, which was held in Birmingham, on the 30th ult., a scheme was adopted for the revision of the Company's capital on the basis of a re-valuation of assets. It was resolved to reduce the capital of the Company from £335,000, divided into 33,500 ordinary shares of £5 each and 33,500 preference shares of £5 each to £167,500, divided into 33,500 ordinary shares of £1 each and 33,500 preference shares of £4 each, bearing dividend at the rate of 6 per cent. instead of 5 per cent.

THE WEBLEY ANNUAL GENERAL MEETING.

MR. ERNEST B. WINN, nephew of the late Mr. Webley, and the newly-elected chairman of the above company, presided at the Annual General Meeting, which was held in Birmingham on the 30th ult. His masterly statement of the position and prospects of the company, so ably summarised the situation, that we give as much of it as considerations of space will allow. After some introductory remarks, he said:—

I propose now to refer to the early history of the company. You will remember that the company consists of an amalgamation of the three firms of P. Webley & Son, W. & C. Scott & Son, and Richard Ellis & Sons. When Messrs. Webley were approached by a London financier with the object of converting their business into a limited liability company, it was in a highly prosperous state, showing steadily increasing turnover and profits. It was thought it might be desirable to acquire two other businesses to amalgamate with theirs, with a view to reducing expenses and lessening competition, and as you know, the Scott and Ellis businesses were taken over. These businesses were for nearly three years managed by their late proprietors separately while building operations were going on in Weaman Street to accommodate the three businesses under the one roof, and although the utmost care and attention was given to the management of all three businesses, it has to be admitted that in the matter of turnover, they had attained their highest point at the time of their acquisition by this company.

Some three years ago it was privately admitted that a grave error in judgment had been made, since, in the absence of a steady demand for revolvers, the Company could not hope to earn sufficient profit to pay a satisfactory dividend upon the very large capital with which it was weighted, and I think you will agree with me that it would have been better to have faced the matter then instead of struggling on hoping for an improvement. This was the view held by my late uncle, Mr. Thomas Webley.

Taking the profit and loss account, you will notice that the first item on the debit side, "rent, rates, taxes, &c.," is nearly £300 less than last year, due to careful watching, while the salaries, office and travelling expenses are nearly £200 more; this is due to special journeys undertaken in India, China, Australia and Canada. Your directors have specially laid themselves out to cater for the trade of Canada, and are hopeful as to future results in this rapidly increasing country. The next item, "law, accountants and patent charges," shows a decrease, while the directors' fees and expenses are over £1,200 less, standing at the figure of £417 10s. for the year 1904. This, I think you will admit, is a very moderate amount for the management of a company of this size. Income tax is somewhat higher than in 1903, due to the fluctuation caused by assessment based on an average of three years.

The repairs and maintenance and depreciation of plant, tools, and buildings, are approximately normal, and do not call for any special comment, while the reserve fund for bad debts has been settled in accordance with the wishes of your accountants, in consultation with those best able to judge of the standing and stability of the debtors. We believe the debtors stand in your balance sheet at a figure worth twenty shillings in the pound. The last item on the debit side of the account—the balance of net profit in twelve months, must be read in conjunction with the first item on the credit side, gross profit brought forward. You will notice the gross profit is £6,000 less than in 1903, while the net profit is £4,500 less. This reduction, gentlemen, is solely due to a diminished turnover, which is some £15,000 less, due principally to the absence of a demand for revolvers. Your directors have had the question of increasing the turnover under their most careful consideration, and they are hopeful that by largely cheapened methods of production, they will shortly be able to deal effectively with the severe competition in a certain class of work emanating from Belgium and America, by offering guns, rifles and revolvers which will show advantages in quality and price over the foreign weapon both to the retailer and to the sportsman.

The interest on investments is less than in 1903, this is due to two causes:—First, to the realisation of part of the outside investments for the purpose of providing money for the ordinary needs of the company; and second, by the fact that in this year no income has been taken credit for from the trading investment in Webley Lebeau Courally Co. This company has suffered somewhat from similar causes to our own, and although a profit has been made, it has been decided to carry the amount forward in their accounts, as it is needed for working capital. Gentlemen, I will now pass on to the balance sheet. The first item on the debit side is the capital authorised and subscribed, this stands at the same figure as last year. The creditors are slightly more, due to the ordinary fluctuation of trade. The reserve fund for bad debts I have before referred to in dealing with the profit and loss account, with the items of special reserve fund, unclaimed dividends, and suspense account, call for no special comment. The revenue account shows a disposable balance or £5,588 7s. 6d., as against £9,602 15s. 2d. in the previous year. This balance, small as it is, allows of the final dividend being paid for the half year upon the preference shares, and your directors recommend that this should be done.

Taking the credit side of the balance sheet, the items of freehold land and building, plant, machinery and tools, office furniture, etc., have been dealt with in the same manner as in previous years, and in view of the re-valuations of these assets, which have been made by professional valuers in connection with the reconstruction scheme, I do not propose to make any remarks at this point. The stock on hand shows an increase of some £5,000, this is almost entirely caused by the policy of manufacture to which I have previously referred, inaugurated in the hope of obtaining an increased turnover, and represents the stocks of finished and partly finished weapons made in accordance with this policy. The debtors, to which I have previously referred, stand at about the same figure as last year, and your directors believe that they are likely to realise every penny of the money. Cash and bills in hand show a decrease caused by the ordinary course of trade, while the investments are less than in 1903 due to sales previously referred to. The outlay on automatic pistols represent sums spent on producing and patenting a weapon which, I am given to understand, fulfils all the requirements of the Government previously laid down, and we believe our automatic pistol stands alone in this respect. The last item on the balance sheet, patents, goodwill, etc., stands at the same figure as last year, and is one of the chief reasons which has caused your directors to bring forward the proposed scheme of reconstruction, resolutions for which will be submitted to you presently.

SHOOTING FROM THE FIXED REST.

RECENT discussions of service rifle tests with the fixed rest have brought into prominence the radical defects of this method of mechanically holding the weapon. While everyone is agreed that shoulder shooting is on the whole the more reliable plan no one appears to have struck at the root of the problem. The back position as used by the match rifle enthusiast produces a perfection of aim, equal to that of the best form of rest, combined with a free lie of the rifle which brings out its true characteristics. A little careful consideration should show us why the fixed rest fails to give the perfection of alignment we naturally expect from a mechanical contrivance. The jar of recoil is accentuated by any solid backing to the rifle butt, and there is every possibility that the jump and vibration of the barrel are modified to a noteworthy but unmeasurable extent by the peculiar method of holding.

Dealing first with recoil we know that a 20 ft.-lb. recoil movement can be brought to rest by a resistance of 40 lbs. acting over a travel of six inches. If the rifle attachment is such that three-quarters of the recoil is absorbed over the first eighth of an inch of travel, this involves a force equal to 1,440 lbs. The holding down of the rifle so as to resist some such shock as this necessarily introduces disturbances of alignment that cannot very well be expressed in figures. A little experiment with an ordinary rifle cleaning rod and a vice will emphasise another important consideration. We hold the rod in the hand by one end, and it appears to lie dead and motionless as regards vibration. We then close the jaws of the vice on the part previously held in the vice and it instantly starts vibrating. We pull the free end with the fingers, and then let it go. It vibrates continuously. Yet the moment we unscrew the vice all movement ceases. This experiment illustrates the fact that any flexible body is peculiarly sensitive to vibratory disturbances when rigidly held at one end. A barrel of a rifle held in a rest is only less sensitive in degree than the steel rod. If we leave the muzzle free, the radius of movement at the moment of firing will produce deviations that are peculiar to the condition of holding the weapon. If we clamp the muzzle to the rest we certainly still the natural vibrations, but we deflect the barrel, and modify its behaviour upon firing in ways that are beyond ordinary calculation. The jump and whip of the barrel in the act of firing are bound to alter the pressure of the fastenings. Hence each shot, while apparently fired under the same conditions as those before and after, is in reality subject to vital differences that are bound to influence the result.

Rifle shooting at the target tells us that the presence of the bayonet will alter the angle of fire. This not surprising, but it is more remarkable but equally true that many promising scores have been spoilt by starting shooting with a cleaning rod firmly screwed into the socket, and continuing without noticing that it has jarred loose. The different forces modifying recoil which are thus brought into play change the movement of the barrel, and so influence the angle of departure of the bullet. If a warted stock, a loose butt, an unduly tight band, badly bedded lugs, or any other of the dozen things the conscientious marksman must guard against, will upset previous calculations it does not seem unreasonable to suppose that the fixed rest by its very nature introduces a host of disturbances that make this class of shooting a byword for unexpectedness of result. Wide and varied experience in the use of this contrivance are necessary to obtain reliable information therefrom. Even then things will run smoothly one day, while on another day, apparently similar treatment produces a host of anomalies that are treated as experimental errors and are promptly struck out.

An untried idea is always a dangerous thing to put forward, and yet we do this in the present instance, feeling that others may make the experiments where we lack the time and opportunity. Briefly stated our idea is this. To suspend a rifle from two strings and fire a succession of shots by an electrical or other trigger operating contrivance that will not disturb the alignment. This idea may be expanded by the naming of certain obvious precautions necessary to make the experiment a success. We should first of all ascertain the centre of gravity of the arm to be tested and attach by india-rubber lacing or other suitable means two loops to act as suspension points. To each of these we should attach adjustable strings or steel wires. For the pulling of the trigger we should adopt a modification of Col. Journée's method of firing a freely suspended gun under test for velocity of recoil. That is to say a spring or elastic band of sufficient strength to release the lock should be coupled to the trigger and this should be resisted by the forward tension of a piece of string. When all is ready for firing the string is burnt, and the trigger is operated. A very successful modification of this appliance consists of a small cylinder and piston which is attached to the trigger-guard. By placing it in a wisp of guncotton and igniting it electrically the necessary trigger movement is obtained. A little ingenious mechanism would certainly provide the means for accomplishing this part of the programme. To obtain perfect alignment on the target, shot by shot, ordinary rifle sights would of course be quite unsuitable; but if a tiny steel point were fixed near the muzzle and another on the toe of the stock and corresponding aligning points were mounted on a solid foundation underneath the rifle it would be quite simple to ensure a microscopic reproduction of the original aim. By arranging that the wires should rest in V notches cut in bars above the rifle and giving these a suitable screw traverse there would be little difficulty in aligning the rifle for each shot so as to compensate for any disturbance of the suspension which arises in the act of firing. With such a pendulum mounting, properly fixed in a covered house and with a suitable buffer for catching the rifle after the shot has been fired, there can be little doubt that we should attain a mechanical form of rest shooting which would perfectly reproduce the conditions of ordinary marksmanship. The bullet clears the muzzle before the rifle has recoiled much more than a tenth of an inch. Thus we may assume that the recoil movement which affects the flight of the bullet takes place independently of the manner in which the rifle is held by the marksman. The mere act of holding the rifle to the shoulder may influence the direction of the bullet, but the peculiarities in respect to the flip and jump are not affected by ordinary holding, whereas they may have quite a different aspect according to the manner in which the weapon is fastened to the moving carriage of the rest.

A LECTURE ON MILITARY RIFLES.

THE subject of military rifles now occupies so much of the attention of the British public that it is not surprising to find a reflection of this interest in the proceedings of the Royal United Service Institution. Major the Hon. T. F. Fremantle delivered a very interesting lecture before this society on the 28th ult. There was an excellent attendance, and Major-General Sir Thomas Fraser occupied the chair. It is evident from the arrangement of the matter prepared by the lecturer that he specially laid himself out to consider the particular points of rifle construction which have been the subject of press comment during the past year or so. For instance, on the subject of length, the lecturer pointed out that from the Snider, 4 ft. 7 in. in length, to the new short Lee-Enfield, 3 ft. 8 in. long, there has been a progressive tendency to diminish the same. Hence we must not regard this as in itself a retrograde step. On the subject of the weight of military rifles, the following comparisons of recoil were put forward by the lecturer:—

	Weight	Velocity of Recoil.	Energy of Recoil.
	lbs. ozs.	ft. per sec.	ft.-lbs.
Snider	9 1	12·05	20·42
Martini-Henry	9 0	13·85	26·11
Lee-Enfield	9 4	9·19	11·9
L.-E. Short Rifle ..	8 2½	10·37	13·4

It is interesting to note that this is the first occasion on which these comparative figures have been published.

When comparing the weight of the various military rifles in service use, we find that the new British rifle stands at the foot of the list with that of Austria, Italy, Roumania and various other 6½ mm. mechanisms next, while Germany, with a 9 lb. rifle, stands at the midway point between 8 and 10 lbs. On the subject of breech mechanism the lecturer pointed out that Great Britain appeared to be armed with a rifle requiring a very low service pressure. Some interesting observations were put forward in considering the relative advantages of rim and rimless ammunition. Cartridges having rims take up more room than those without, in packing and in the magazine, while in addition to this they are more liable to cause jamming of the cartridge when feeding into the chamber. The general objection to the rimless cartridge, that they have nothing but the taper at the neck to prevent their being forced too far forward into the chamber, is to some extent met by the fact that they are held in place by the extractor hook. The Japanese have adopted a cartridge case grooved for the extractor, having also a very narrow rounded rim projecting enough to give a bearing in the chamber, but not enough to prevent one cartridge sliding over another in feeding up into the magazine. The lecturer seemed to think very highly of this compromise, which though not a new invention, appears to have advantages where magazines are used in combination with clip loading.

The following table of dangerous zones for an object 3 ft. high at 1,000 yards, affords us a sound explanation for the favour with which Major Fremantle undoubtedly regards the high velocity of the 6½ mm. or ·256 cartridge.

With the Enfield to within 6 yards one way or the other.
" Martini-Henry 8½ " "
" ·303 13 " "
" ·256 15 " "

Whether or not this would be a satisfactory cartridge for the British army must be determined by considerations of the demand for greater stopping power when dealing with the savage races which a colonising power is more likely to encounter than a continental nation. This of course raises the question whether we can increase the velocity while retaining the ·303 bullet, and the lecturer gave many excellent reasons for the adoption of such a course. It was nevertheless clear that he regarded ·256 calibre as the handy and efficient military cartridge for all-round work. Considerations of weight and recoil [redacted] undoubtedly be taken into account in deciding such a question. In speaking of pressure, the lecturer pointed out that great strength of breech mechanism was desirable in a military weapon, in order that the necessary velocity could be obtained with an absence of so high a muzzle pressure as would disturb the flight of the bullet on emerging from the bore. While Major Fremantle considers the ·303 rifle, with a well-made barrel and properly designed ammunition, capable of making quite as accurate shooting as the best of the continental models, he is of opinion that the new short rifle, as produced in the ordinary run of manufacture, does not attain the standard of behaviour of the experimental patterns.

The following interesting comparative table, showing the extreme distances to which the rifles of various countries are sighted, was submitted by the lecturer:—

United States (1898 Krag-Jorgensen)	1,800 yards
Denmark	2,078 "
Russia	2,096 "
Austria, Bulgaria, Greece	2,132 "
Belgium, France, Germany, Holland, Italy, Japan, Roumania, Spain, Switzerland	2,187 "
Portugal	2,406 "
Great Britain	2,800 "

As regards rapidity of fire with automatic rifles, it is well-known that where the recoil is enough to shift the alignment of the barrel, the time necessary to recover the aim much limits the possible rapidity. Consequently the rapidity of fire over a measured period of time is not materially greater than with an ordinary turn-bolt mechanism. In the course of the discussion which followed the lecture, it was pointed out that the automatic rifle was nevertheless a very advantageous contrivance, because it obviated the need for removing the weapon from the shoulder, and thereby enabling a succession of shots to be delivered in a far shorter time than with an ordinary mechanism. If, therefore, an automatic weapon of sufficiently simple design could be produced, it would be likely to be adopted by military nations. Considerations of cost and increased difficulties in the supply of ammunition, presuming that the automatic rifle would consume more rounds in a given time, would not be allowed to stand in the way of its adoption. But in the opinion of the lecturer the time is not yet ripe for the introduction on a practical scale of this class of weapon. Meanwhile, the best opinion decidedly leans towards the use of velocities

from 2,300 to 2,400 ft. per second, and it is possible that even these figures may be notably enhanced. Major Fremantle is, however, of opinion that these changes are likely to be accompanied by the abandonment of calibres larger than ·256. Moreover, he demands from the bolt action ample resisting power as provided by lugs placed at the head of the bolt, with a weight of rifle not much less than 8½ lbs. Accompanying these changes the cartridges should, of course, be practically rimless.

All we can say in summary of this lecture is that the programme of reform which Major Fremantle lays down as most desirable, involves nothing more than the adoption of improvements in our own arm for which we have ten or fifteen-year old precedents in the weapons of foreign nations. Our match rifle enthusiasts, whose number but little exceeds 100, and of whom the lecturer is a shining example, are probably as a class the most highly trained and most expert marksmen in the entire world. By reason of the refinements of sighting they use, and the long distances at which they commonly shoot, they have more knowledge of military rifles than anyone using ordinary service sighting can possibly acquire. With such splendid facilities for expert testing, it is a pity that some of the more obvious lessons taught by match rifle shooting cannot be put into practice.

RIFLE CLUB CONFERENCE IN LEEDS.

WITH the sanction of the National Rifle Association a conference of representatives from North of England rifle clubs was held at the Hotel Metropole, Leeds, recently, the object being to discuss the consolidation of the rifle club movement; to consider means whereby its permanency might be secured by co-operation with the N.R.A.; and to discuss anything further whereby the individual expense of securing arms and ammunition might be reduced to a minimum. Mr. Alfred Hutley (Leeds) was in the chair, and in addition to Lieut.-Col. C. R. Crosse (secretary of the N.R.A.) and Major Goodyear (secretary Yorkshire Rifle Association), there were present representatives from the following rifle clubs: Leeds, Scarborough, Sheffield, Huddersfield and District, Blackpool, Lytham, Ravenglass and District, Barnsley, Liverpool Corn Trade, Dunkinfield, Bedale and District, Newark and District, Darlington, Calder Valley, Bolsterton, Urmston, 1st Lancashire Royal Garrison Artillery (Volunteers), Norton (Derbyshire), Denaby Main and District, Bishop Auckland, Flockton, Felling, Northern Civilian, Sheffield and Hallamshire, Nottingham Civilian, and City of Newcastle. Expressions of approval with the objects of the conference were received from a number of other North of England clubs which were unable to send representatives.

The Chairman urged that their business was to formulate a temperate resolution which could be submitted to the Secretary of State for War. This motion should be a practicable one, and should aim at making rifle clubs not only useful in a military sense—he used the term advisedly—but also in a personal sense. It had been thought that rifle clubs would do harm to the Volunteer movement, but in no district where rifle clubs were flourishing had the Volunteer movement diminished in the slightest degree; indeed, on the other hand, there had been a marked increase in the Volunteer and Yeomanry movements, and taking Leeds alone he could say that not only had the Volunteers been augmented by first-class shots from the rifle clubs, but in the Yorkshire Yeomanry some of the very best shots had been novices taken from the Leeds Rifle Club. That showed that the rifle club movement had been productive of a considerable amount of good.

Mr. C. H. Barnard (Denaby Main) spoke of the difficulty of getting full ranges, and contended that if there was to be a large increase in the riflemen in the country it must come through the miniature ranges. It had been suggested that the Government should grant free ammunition through the N.R.A. Personally, he would like to see a grant made to the clubs in proportion to the skilled shot certificates that had been obtained; in that way the Government would be getting value for money.

Lieut.-Col. Crosse stated frankly that he did not believe they would ever get free ammunition from the War Office (hear, hear). He thought they could get rifles at a very much reduced rate. On the question of ammunition, it was just possible the War Office might make some concession on certificates—he rather liked the certificate idea because it was something tangible. It should be understood, however, that under any circumstances the War Office would only grant the kinds of ammunition they possessed, no matter if the rifle clubs had selected some other sort.

Mr. H. Dearden (Sheffield) also expressed the opinion that they would not get ammunition free. They ought, however, to ask for something, and at the same time offer the Government something in return. Rifle clubs had been called an armed mob, and certainly they did not know anything about drill, so what use would they be in fighting? If they would take a certain amount of drill and become efficient on that point, then he had no doubt the Government would make some concession.

Mr. J. Hutton (Scarborough) said the great bar which prevented the working man joining the movement was the question of expense; he could not stand it. He (the speaker) would like the Government to give serious consideration to the question of granting the use of Government ranges free of charge to all rifle clubs affiliated to the N.R.A.

Mr. Wilmshurst (Huddersfield) said the whole point was with regard to securing cheap arms and ammunition. He did not think the N.R.A. could do anything for them; they must look to the Government. He suggested that a member of a rifle club should have the privilege of purchasing a rifle from the Government at cost price, if necessary, and in return the man should give in his name and should be relied upon by the Government for the purposes of home defence if found necessary. He thought there should be a grant of ammunition based upon the efficiency of each rifle club. He agreed that free ammunition would lead to waste. Lieut.-Col. Crosse urged that the N.R.A. had done something for rifle clubs, and so had the War Office.

After some further discussion Mr. C. Bettison (Leeds) moved a resolution "That this meeting of representatives of rifle clubs of the North of England is unanimously of opinion, and respectfully submits to His Majesty's Government that it is desirable in the interests of the rifle club movement, and as a means of maintaining an efficient body of marksmen for home defence, that some greater concessions should be made

to the rifle clubs affiliated to the N.R.A.; and it is further submitted that where possible Government ranges should be placed at the disposal of rifle clubs under proper supervision, and that arms and ammunition should be dealt out in such form that the expenses of each club may be reduced to a minimum." The resolution was carried unanimously.

TRADE MARKS.

ADVERTISED. MARCH 1—22, 1905.

269,837. The word ABBCITE. Kynoch, Ld., Birmingham. To apply to explosive substances Feb. 2, 1905.

REGISTERED FEBRUARY 16—MARCH 15, 1905.

265,774. J A. Tickner.
268,548.) Nobel's Explosives Co. Ld.
268,577.)
218,875. The Schultze Gunpowder Co., Ld.

APPLICATIONS FOR PATENTS.

FEBRUARY 20—MARCH 25, 1905,

3,553.* Blasting Fuse Heads. F. Render.
3,554.* Blasting Detonator Fuses. F. Render.
3,662. Targets. A. Winser.
3,725. Guncotton Block Manufacture. A. Musker.
3,789. A New Explosive. The Marquis Roberto Imperiali.
3,804. Gun Carriages. A. T. Dawson and G. T. Buckham.
3,921. Projectiles. W. H. Harvey.
3,970.* Ordnance Brake Mechanism. Fried. Krupp, Ag. (Date of application in Germany, March 31, 1904).
4,036.* Cartridge Ejector. J. T. S. Schouboe.
4,051.* Targets. P. M. Justice (Agent for *Bethlehem Steel Co.*).
4,057. Explosives. J. Wetter (Agent for *Westfälisch-Anhaltische Sprengstoff Ag.*).
4,072. Ordnance. Sir W. G. Armstrong, Whitworth & Co., Ld., and S. M. Murray.
4,101.* Automatic Arms Trigger Mechanism. J. T. S. Schouboe.
4,179. Projectile Fuses. R. P. R Enbury and F. Wigley.
4,189.* A New Explosive. H. Judd.
4,275. Imitating Firearm Sounds. J. Smith.
4,372.* Explosives. E. Louis. (Date of application in France, March 2, 1904).
4,472. Small-Arms. W. Evans and W. Corrie.
4,626.* Trigger Guards. A. P. Doig.
4,676. Projectile Fuse. Cammell, Laird & Co., Ld., and L. Burrows.
4,734. Ordnance. A. Reichwald (Agent for *Fried. Krupp*).
4,735.* Ordnance Sighting. Fried Krupp, Ag. (Date of application in Germany, April 14, 1904).
4,922. Ordnance. W. Beardmore & Co., and A. Bremberg.
4,968. Explosives. J. C. Gonsalves.
4,969. Explosives and Primers. J. C. Gonsalves.
4,970. Blasting Cartridges. J. C. Gonsalves.
5,131.* Firearms. K. G. von Pocci. (Date of application in Belgium, March 14, 1904).
5,254.* Rifle Sight. M. E. Sutherland.
5,315 Rifle Sight Attachment. R. E. C. Gompertz.
5,327.* Projectiles. Fried. Krupp, Ag. (Date of application in Germany, April 20, 1904).
5,328.* Ordnance. Fried Krupp, Ag. (Date of application in Germany, April 20, 1904).
5,505. Range Finder. A. Oldbury.
5,519* Rifle Carrier. H. E Coles.
5,578. Rifle Carrier. G. R. Cawley (Agent for *A. J. R. Glasford*).
5,600. Gun Carriage. W. H. Robson and F. Ward.
5,687.* A New Explosive. G. Schultz.
5,705. Target. W. Winter.
5,767. Loading Cartridges. J. C. Gonsalves.
5,824. Range Finder. J. W. Meek.
5,838. Rifles. O. Jones.
5,931. Trigger Guard Shields. G. T. Glover.
5,985. Explosives. C. G. Démétriade, C. Joneseu, and H. C. Williams.
5,994.* Gun Sights. A. J. Boult (Agent for *Dr. F. A. Schanz*).
6,045.* Explosives. A. C. Girard. (Date of application in France, April 5, 1904).
6,125. Bullet Treatment. King's Norton Metal Co., Ld., T. A. Bayliss, H. M. Smith and H. W. Brownsdon.
6,154. Automatic Guns. A. T. Dawson and J. Ramsey.
6,155.* Gun Carriages. A. H. Emery.
6,279. Safety Device for Small Arms. C. H. Hansen.
6,299 * Ordnance. H. H. Lake (Agent for *U.S. Rapid Fire Gun and Powder Co.*).
6,339. Double Barrel Guns. F. Garrett.
6,352. Use of Condensed Powders. G F. Bentner.
6,361. Explosives. J. Wetter (Agent for *The Westfälisch-Anhaltische Sprengstoff Ag*).

*These Applications were accompanied by complete Specifications

SPECIFICATIONS PUBLISHED.

MARCH 2nd—23rd, 1905.

COMPILED BY HENRY TARRANT.

3,333 (1904). **Range Finder.** R. Bryant, London. A range finder consisting of two object glasses set at a predetermined angle and adapted to transmit images of the object sighted to a common focus. The second glass transmits the image through an adjustable reflector. The dimensions of the angle traversed during adjustment is read off a scale and from this a simple calculation reveals the range. Accepted February 9, 1905.

3,496 (1904). **Breech Adapter for Miniature Cartridges.** F. Cantello, Sandown, I of W. An ordinary long rifle cartridge case is provided with a bushing consisting of steel covered with some non-rusting metal The bushing is bored to take the smaller cartridge. Accepted February 9, 1905.

6,254 (1904). **Back Sight for Rifles.** R. A. Rogers and F. Cantello, Sandown, I. of W. The bar of an ordinary leaf back sight is so mounted as to be capable of a rotary motion. The bar is provided with four carriers of v notches. Either of these v notches, which are situated at different points laterally along the bar, may be turned up and used for the purpose of counteracting wind. Accepted February 9, 1905.

6,802* (1904). **The Price Single-Trigger Mechanism.** H. Price, Handsworth.

8,037 (1904). **Armour Piercing Projectiles.** J. R. Hoyle, Sheffield; and A. Anderson, Dore. A method of securing the soft cap to the hard lead of the projectile consisting in cutting corresponding grooves in each and running fusible material such as white metal therein. The inner surface of the cap and the nose of the projectile are also tinned before they are amalgamated. Accepted February 9, 1905.

8,041 (1904). **Dinitroglycerin Explosives.** A. Mikolajczak, Germany. A process of manufacturing blasting explosives or gunpowder consisting in employing in the place of trinitroglycerin, $C_3 H_5 (O.NO_2)_3$, either pure dinitroglycerin, $C_3 H_5 (O.NO_2)_2 O H$, or dinitroglycerin mixed with trinitroglycerin An example of an explosive so formed is as follows:—Dinitroglycerin 38·4 per cent., trinitroglycerin 25·6 per cent., soluble pyroxyline 1·7 per cent., sodium nitrate 27·0 per cent., and wood meal 7·3 per cent. Many variations are set out, and the method of manufacture of dinitroglycerin is also fully dealt with. Accepted February 23, 1905.

8,181 (1904). **Cartridge Charger for Magazines.** L. S. Hollings, Handsworth. A cartridge holding clip or charger for the magazines of rifles formed of a perforated sheet steel blank bent into a trough shape in cross section. Two spring tongues are cracked out of the sides of the clip so formed to hold the cartridges in the charger. These tongues hold the cartridges no matter whether their flanges overlap or not. Accepted February 9, 1905.

8,448 (1904). **Air Gun Slug Box.** J. H. Allcock, Redditch. A cylindrical box the bottom which is bulged at one part whilst the top is provided with a hole in its side. When the top is twisted round so that the hole is opposite to the bulge or spout a slug contained in the box falls out ready to hand. Accepted February 16, 1905

8,811 (1904). **Rifle Sights.** L G. P. Thring, Guildford. In Patent No. 27,264 of 1903 a system of sights was described

in which a line of sight was taken through the back sight and a subsidiary foresight. The present patent covers a method of arranging these two sights so that the shooter can select different points on the sights for different ranges. Accepted February 16, 1905.

8,964 (1904). **Cartridge Container**. P. Dagnall, London. A rectangular metallic box covered with leather is divided into two compartments which are adapted to contain a number of cartridges of any gauge. An automatic feeding device arranged at the bottom of each compartment is governed by a spring lever which frees a cartridge every time it is operated. Accepted February 9, 1905.

7,882 (1904). **Armour Piercing Projectile.** R. A. Hadfield, Sheffield. An armour piercing projectile made of nickel chromium steel of the kind described in Patents Nos. 27,753, 27,754 and 27,755 of 1897, but containing a lower percentage of carbon than usual, is set out in this Patent. The projectile is prepared by one or other of the methods dealt with in Patents Nos. 16,131 of 1901, 7,778 or 25,973 of 1902. The projectile is hardened by heating to 720–820 degs. C. and by dipping point downwards into oil—to a depth only to which it is necessary to harden. Accepted February 9, 1905.

9,153 (1904). **Air Gun Breech Mechanism**. F. S. Cox, Handsworth. Breech mechanism for air guns of the break-down type is designed so as to form not only a close and air-tight joint between the closed breech and barrel, but at the same time to take up or compensate the slackness of the barrel joint caused by the barrel being used as a lever for compressing the plunger spring. Accepted February 9, 1905.

9,286 (1904). **Field Gun Carriages**. S. B. Apostoloff, London. A gun carriage so constructed as to allow of the horse being behind instead of in front. The shafts are fixed on the rear axle and the horse pushes instead of pulls. The carriage is guided by the gunner much in the same way as a motor car. Accepted February 23, 1905.

9,782 (1904). **Ordnance Firing.** W. R. Swain, Dublin. A method of increasing the velocity of ordnance projectiles consisting in exhausting the air from the bore before firing. An air-tight cap is arranged over the muzzle and a suction washer behind the projectile. The atmospheric pressure on the rear of the projectile and the absence of resistance in front is claimed to help the powder charge instantaneously to start the projectile up the bore. Velocity is increased and recoil decreased. Accepted March 2, 1905.

10,288 (1904). **Miniature Practice Cartridge**. W. H. Trask, London. A specially made case conforming in outward dimensions with the service rifle cartridge is fitted with a bullet which may be pressed into the case by the fingers. The case is provided with a removable cap and powder chamber. When fired the case is simply reloaded with a bullet and a new powder chamber. Accepted March 2, 1905.

13,069 (1904). **Shot Construction**. C., J. B., E., and H. W. Lane, London. Shot for sporting guns or air guns constructed to give greater range in the case of shot guns and better fitting and greater accuracy in the case of air guns. The surface of the shot is roughened or milled at regular or irregular intervals. The spherical figure of the shot may be perfected also in the roughing operation. Accepted February 16, 1905.

14,208* (1904). **Blank Cartridges for Small Bores**. The King's Norton Metal Co., Ld., and T. A. Bayliss, London; and H. M. Smith, Abbey Wood.

15,322 (1904). **Electric Target Indicator.** Capt. C. Chevallier and E. Cadet, France. The closing of an electric current brought about by the impact of a bullet on any particular segment on the target described, is arranged to be of sufficient duration positively to operate the indicator at the firing point. A nut is rotated upwards by the target movement and its inertia keeps it in contact longer than would the momentary displacement of the target section. Accepted February 23, 1905.

15,786 (1904). **Automatic Rifle Mechanism**. W. M. Vandegrift, U.S.A. Rifle mechanism automatically operated by the recoil, a special feature of which is an arrangement whereby the hammer may be recocked after a misfire without disturbing the locked breech. The parts may be distributed or assembled without the aid of tools. Accepted February 16, 1905.

18,442 (1904). **Turret Gun Loading Apparatus**. C. P. E. Schneider, France. In this profusely illustrated patent is set out an arrangement which permits of operating, by means of one and the same driving apparatus, the ammunition hoist and the ramming mechanism mounted thereon adapted to deliver fixed ammunition to guns situated in turrets. The rammer is actuated by the same part which serves to raise and lower the ammunition cage. Accepted March 2, 1905.

26,169 (1904). **Torpedo Launching Apparatus.** A. E. Jones, Hungary. Broadside underwater torpedo launching apparatus, in which a shield or bar is pushed out together with the torpedo, is provided with a part moveable longitudinally relatively to the shield. This part is adapted to ensure that the shield and torpedo shall come exactly simultaneously into position for slipping the torpedo. Accepted February 9, 1905.

29,432 (1904). **Sporting Gun with Fixed Barrels.** L. Charlin and J. Santist, France. In sporting guns with fixed barrels the breech locking is effected by a vertically moving locking bolt actuated by a key. The breech when unlocked is drawn away from the barrels towards the butt by a sliding movement and during this operation the hammers are cocked. Accepted February 16, 1905.

296 (1905). **Combined Shot Gun and Rifle**. W. Smith, U.S.A. The combination with a shot gun barrel of a rifle tube which may be quickly mounted or removed. The end of the tube is provided with a flange adapted to fit the cartridge rim recess in the shot barrel. Springs on the outer surface of the tube hold it by frictional contact securely within the shot barrel. The ordinary extractor is utilized to eject the rifle cartridge cases. Accepted March 2, 1905.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

THE PRICE SINGLE-TRIGGER MECHANISM.

6,802 (1904). H. Price, Birmingham. A system of selective single-trigger mechanism is set out in this specification. The two barrels are discharged in either order through the medium of a switch arm, which is turned from a position beneath one sear to the second sear during the operation of firing. The involuntary pull is rendered abortive by a sliding part which is jarred forward by the recoil and is caused to hold the trigger in its raised position. The switch arm is thus prevented from taking up its berth beneath the second sear until the recoil has passed away.

In the drawings reproduced the mechanism is fully illustrated. The single trigger *a* is pivoted in the usual way in the block *b*. The switch arm *c* is pivoted on the post *d* on the back of the trigger blade. The arrangement of this part is best shown in Figs. 3 and 5. It is held in either of its two fixed positions—*i.e.* beneath either one of the sears—by the spring *e*, the knife edge *f*, which rides over the corresponding edge *g* of the arm upright (see detailed drawings), and by its spring action completes the movement of the arm in either direction. The arm's movement is started by either one of the plates *h* and *i*, which are so arranged as to be capable of a sliding movement upon the sides of the trigger box *b*. The slides are pulled always towards the hammers by the spring *j*, which engages the projections *k* attached to the inside faces of the plates. When the gun is broken down for reloading, the turning of the top lever causes the part *l* attached to the breech locking bolt to engage the projection *k* on the end of the left-hand plate *i*, and so push it forward against the pressure of the spring *j*. The extension *m* of the slide *i* engages the edge *n* of the switch arm and, turning this part on its pivot, enters its nose *o* beneath the right-hand sear. When the trigger is raised the right-hand barrel is discharged, and, whilst still in the raised position, the peg *p* on the falling right-hand hammer engages the inclined edge on the end of the slide *h* (Figs. 1 and 3). The slide is in this manner forced forward and the switch arm is turned towards the left-hand sear by the abutment of the extension *q* against its shoulder *r*. The recoil

of discharge, however, has jarred the sliding part *s* forward against the pressure of the spring *t* to the position illustrated in Fig. 5. Before the trigger can recover normal position the projection *u* has entered beneath the extension *v* and momentarily holds the trigger in its raised position. The switch arm is, of course, elevated also, and its nose *w* is allowed to abut only against the left-hand sear until the sliding part *s* rides back and allows the trigger to drop into its proper position. The involuntary pull passes harmlessly during this period of interruption. When the gun is again broken down, after the second discharge, the same process of movement occurs as has been described.

Supposing it is desired to discharge the left-hand barrel first, the slide *y* beneath the trigger plate is operated to turn the switch arm over to the left-hand sear. The falling of the left-hand hammer completes the cycle of movements, placing the parts in position for the discharge of the right-hand barrel. The sliding part *s* acts

Fig. 1

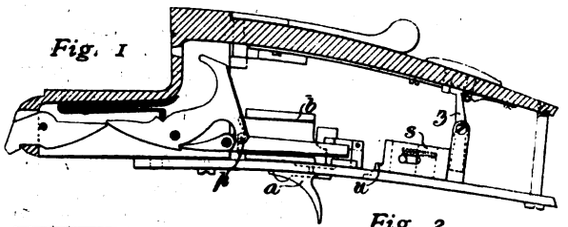


Fig. 2

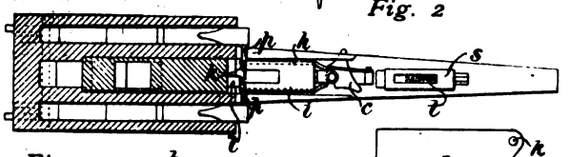


Fig. 3

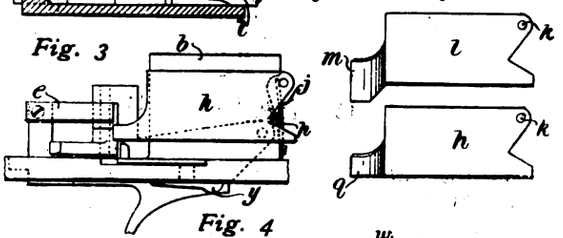


Fig. 4

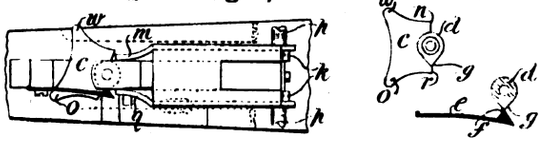
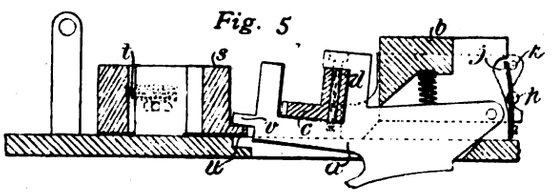


Fig. 5



also as a safety. The turning of the top lever rotates the lever *z* on its pivot, and so pushes the part *s* forward, its projection *u* taking up a position above the extension *v* of the trigger. Accepted February 9, 1905.

BLANK CARTRIDGES FOR SMALL-ARMS.

14,208 (1904). King's Norton Metal Co., Ltd., T. A. Bayliss, London, and H. M. Smith, Abbey Wood. A blank cartridge for small bores is dealt with in this patent. Outwardly the blank has much the same form as an ordinary cartridge (see Fig. 1), and may be fed and actuated by the magazine mechanism of the service rifle. It possesses a mock bullet consisting of a slightly conical or taper metallic tube which is nearly closed at its nose by crimping and at its base by a wad rigidly secured. The tube cannot be fired away from the cartridge case by the force of the discharge.

The cartridge case *a* is provided near its open end with the cannelure *b*. The tubular mock bullet *c* is slightly taper in shape, and it possesses a shoulder *g* near its larger end which is of a suitable size to fit the open end of the cartridge case. The rear of the bullet abuts against the cannelure *b*, and the mouth of the cartridge case is closed over the body of the bullet by contraction. The bullet is in this way rendered immovable with respect to the case *a*. The wad *d* is fitted in the open end of the bullet before it

Fig. 1

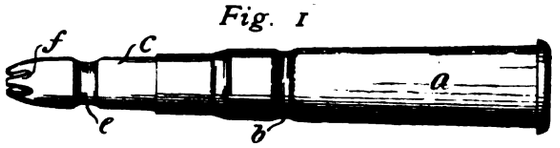


Fig. 2

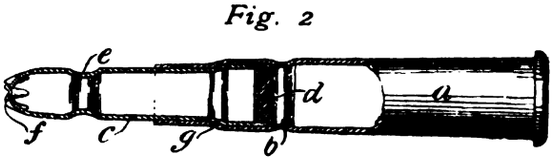
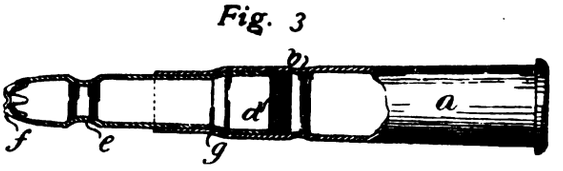


Fig. 3



is connected with the cartridge case, or it may be placed against the cannelure *b*, the end of the bullet abutting against it as in Fig. 3. To increase the adhesion of the wad, a waterproofing substance may be applied thereto. The nose *f* of the bullet is crimped, and a cannelure is formed at *e*. The resistance is in this way increased. The form of the bullet renders recognition easy, and further it is chemically blackened so as to obtain a strong visual contrast between the blank and the ball cartridge. The interior of the blank may be waterproofed to permit of the use of hygroscopic powders, such as gun cotton. Accepted March 2, 1905.

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CONTENTS.

CURRENT TOPICS.

The Miniature Meeting at Exeter.—Everyone seems to be agreed that the rifle meeting at Exeter was a great success; yet no very considerable machinery was necessary to attain the result in question. An outfit of target apparatus was borrowed for the occasion. The local drill hall was duly fitted up with no more than a piece of rope suspended from the gallery to divide off the firing line. A matter of £70 or so was put up in prizes, and against this about £40 in entries were received before the meeting opened. Staff and other expenses may have increased the cost to a couple of hundred pounds, but there is nothing in the meeting which a committee of local residents could not, given the necessary enthusiasm, equally well accomplish for themselves, provided they could be assured beforehand of recognition for their efforts by the parent Association. We trust that the National Rifle Association will not allow this side of their recent achievement to lapse from view. Such meetings produce a spirit of emulation amongst the contestants, and it is a matter of common experience that shooters will practice diligently for many months in anticipation of an important contest, from which the net result to themselves may be very little more than position in a prize list and the holding of a bronze medal as a memento of the occasion. In rifle club work the successful result is largely attained by suitably humouring the peculiar manifestations of human nature. This the National Rifle Association has been highly successful in accomplishing, and although much of its success was doubtless due to the personal interest shown by prominent members of the Council, this personal interest might on another occasion be replaced from local sources. If each year the N.R.A. holds one such meeting in a selected centre of rifle club activity, it is likely that before long we shall find local associations and local championship meetings an important feature of this highly successful sport.

Service *v.* Miniature Rifles.—Although the conditions at Exeter militated against the successful display of the miniature rifle, there can be no gainsaying the fact that considering the nature of the conditions, the service arm produced in the hands of the shooters present a marvellous perfection of result. This success cannot be attributed to the use of any particular system of adapter. The Morris tube did good work, as also did the Kynoch adapter, the Trask adapter, and even empty service cartridges carrying a reduced charge. While we cannot speak with any great enthusiasm of the Morris tube and its cartridge, we do know that the adapter that carries a bullet suited to the ·303 barrel travels with unerring accuracy over the 25-yards distance that ruled the meeting. A good deal of trouble was experienced by the fact that the fixed alignment of the sights on the service rifle was not applicable to the reduced charge used. The necessary readjustment was not easy to make; and many shooters were accordingly handicapped by the persistent desire of their rifles to make excellent groups away from the bull. So soon as we possess a service rifle with lateral movement of the sights, the standard of performance will closely approach that of the best miniature weapon available. The service rifle is necessarily a very expensive form of armament for miniature work, both as regards the cost of the rifle and that of the ammunition. In our opinion the supreme virtue of the service weapon for this class of practice consists in the considerable distance of the backsight and foresight from the

eye, and the ease with which very slight changes of elevation can be effected. Adding to these the convenience of the sling attachment, which is absent in many miniature rifles, we find that the service weapon possesses very important attributes towards success. In order that the miniature weapon may combine these advantages with low cost, both of weapon and of ammunition, it is necessary that it should be made as far as possible with the same length over all and the same general balance. It will then be a close race between the two as to which is superior from the point of view of accuracy, considerations of cost being excluded. The design of miniature weapons is at the present time prejudicially affected by the circumstance that their length and general fittings are standardised more especially with a view to the use of aperture sights, whereas if open sights were primarily considered certain existing disadvantages of size would be remedied.

Our Lecture on Wind Deflection.—Our lecture this month deals with an exceedingly difficult subject, and experts of the highest standing are not invariably in agreement concerning the scientific basis of their arguments. The difficulty is that such practical information as exists is mainly in the hands of the rifle shot who is oftentimes none too accurate an observer. For instance, it is commonly reckoned that the 6½ mm. Mannlicher bullet is more deflected by wind than the ·303. Only lately it has been suggested to us that this belief arises from the circumstance that many shooters with the match rifle are in the habit of changing their sights from one weapon to another without altering the scale. The difference in length between the sight base of the two rifles when fitted with match sights would thus give a different value to the graduations showing wind allowance, whereby the same number of divisions would produce a varying amount of deflection in aim according to the rifle on which the sights are fixed. Although the match rifle shot knows a great deal more about rifle shooting in its scientific aspects than any other class of marksman, even he is liable to such mistakes as this. However, it is only by examining a large amount of expert evidence that anything approaching a clear understanding of the controlling influences can be acquired. In the present lecture we have endeavoured to combine the scientific with the practical, so as to show the reader the relation that exists between the observed deflection of the bullet and the underlying theory which is capable of mathematical proof. Many formulæ of a rough-and-ready character have been put forward by different shooters; but very few of them are properly harmonised with sufficient theoretical knowledge to make them acceptable to scientists. It is possible that the lecture as now presented would bear a very different aspect if written five years hence; but our immediate aim is to show the position of existing knowledge with a view to carrying that knowledge further as our supply of detailed observations becomes greater.

M.D. Cordite.—The announcement that Messrs. Kynoch have produced a modified form of explosive for use in express and other types of high-power cordite rifles leads us to suppose that we are on the eve of important developments revising the composition of our service explosive. Lord Donoughmore, in the House of Lords some time ago, mentioned that experiments were taking place, the object of which was to impart to the small arm the advantages which followed from the use of M.D. cordite in quick-firing guns. The alteration in the balance of the nitroglycerin and gun-cotton constituents had produced a highly brittle and horny explosive which, though it can be squirted into cords or ribbons, is likely to introduce difficulties in winding on a reel and cutting into lengths for loading purposes. In what particular manner Messrs. Kynoch have overcome this difficulty we do not know, but it is quite possible that practical manufacturing reasons may necessitate a departure in the case of M.D. cordite from the familiar form of cord. Such changes are of necessity likely to be considered very carefully at a time when every penny of additional expense is curtailed by the financial department. The popular remedy of a floating loan is hardly applicable to a change of this character, and anything that enters into the estimates must be closely scrutinised. We accordingly find that whatever may be the probable advantages of M.D. cordite when used in small arms, some time is likely to elapse before the change is incorporated into the service cartridge, Meanwhile we have in the new explosive "Axite" a basis for careful examination of shooting results; and it is likely that we shall before long be in a position to say how far such an explosive will give us the good qualities which we expect in a smokeless propellant. The pamphlet on "Axite" tells us that special means have been adopted for diminishing erosion of the barrel. From general information available, we incline to the belief that this effect has been produced by the manufacture of an explosive which leaves a more pronounced deposit of solid fouling in the bore, whereby the contact of the bullet with the metal of the barrel is to some extent prevented. This appears to be a development on sound lines, since the nickelling up of the barrel produces disadvantages which only the educated rifle shot can fully appreciate.

The Rook Shooting Season.—This month heralds a certain amount of welcome activity in a business which is ordinarily dull during the earlier part of the summer. The rook does not bring to the coffers of the gunmaker the harvest of small sales which was customary twenty years ago. This class of shooting seems to be distinctly on the wane, a loss which is partly occasioned by a diminution in the extent of our rookeries by reason of the newly developed taste of this bird for game chicks and eggs. Of the rookeries that remain many are contained in areas where the principle of sanctuary is observed the thinning of the birds being left till a later season when they trespass on neighbouring fields and preserves. However, rook shooting parties are still a much-enjoyed festivity in many districts, and the man who is a rifle shot for once in a year goes to his gunmaker for the means of cleansing the neglected barrel and for ammunition to shoot from it. Another class of rook shooter, he who uses the small calibre rifle during most of the year, is coming to the front. With well adjusted sights at a close shooting rifle he has little difficulty in accounting for what may appear to his fellow guests to be a phenomenal number of successful shots. Whether the the sale be for a couple of hundred rim-fire cartridges, or for the same number of the more expensive central-fire kinds, the business in country districts which comes with the rook season, must not be disregarded because of its apparently unimportant proportions.

THE PROOF HOUSE REPORT AND ITS LESSONS.

THE Birmingham Proof House returns display in even a more marked fashion than we have feared the state of stagnation which has been evident for such a long time past. The Birmingham trade has but very few specialities. The shot gun and the sporting rifle represent about the only two things which the gun trade manufactures in any large quantities. This, of course, does not include pistols, though here again we find a marked deterioration, due, no doubt, in a great measure to the Pistols Act. The organisation of the Birmingham gun trade is mainly based upon a highly refined system of labour division. A gun is chiefly produced by hand labour, and this finds its most perfect development when every process is carried out by a specialist. Cheapness by such a method of manufacture can only attain a certain level. A partial and temporary means of securing greater economy is found by purchasing components and partly finished work from a centre like Belgium, where cheap production arising from long hours and low wages is carried to its ultimate conclusion. What applies to the shot-gun is also reproduced in the high-class sporting rifle. We cannot, however, lose sight of the unfortunate circumstance that proofs are ever diminishing during a period in the history of firearms when shooting is on the increase. In America they have undoubtedly more labour difficulties than are prevalent on this side; but notwithstanding the several disadvantages that country continues to supply the world with inexpensive rifles suitable for target practice at clubs and elsewhere. In spite even of the enormous vogue of the air-gun in Birmingham, we find that supplies from abroad mostly control the market. This, however, is not a Proof House question.

Although a large section of the Birminghnm trade still depends very much upon the efficiency and cheapness of organised hand labour, it cannot be denied that we have in several factories most excellent facilities for the turning out of large qnantities of firearms on the interchangeable system. We do not, however, see the tendency we should welcome on the part of firms possessing such facilities to fill up the gaps in their regular work by the manufacture of club rifles and so forth. If, for instance, instead of reading that the B.S.A. factory is discharging workpeople because of the lack of Government orders, we could witness the continuance of activity in other branches of manufacture, we should feel that things were not universally wrong. The ·22 bore rifle is undoubtedly the most used weapon in this country, and so perfect are the results that can be obtained with a good model of the same, that we see no reason why these should not be turned out on a scale that would at least pay establishment expenses, as against the losses caused by empty shops. The chief difficulty which appears to be encountered is that the firms who are most capable of manufacturing perfect weapons are worst provided with expert rifle shooting knowledge and designing facilities. A miniature rifle, whatever may be its characteristics, is judged by the purchaser according to its capacity to meet his requirements. The barrel must be chambered and bored upon a carefully devised system which will ensure the most perfect shooting that can be obtained from the appropriate cartridge. This cannot be determined in a day, but when success has been reached the rifle possesses at least one element involving saleability. The next requirement is to ascertain exactly what the mechanism is expected to do. If the cartridge must be ejected mere extraction is not sufficient. Then, again, if competitive shooting involves reloading within a small time limit, the mechanism must be capable of satisfying the required conditions. More than this, if perfect holding is required, and the shooter desires that the rifle shall respond to the highest achievements of human skill, there must be nothing in the general design and manufacture of the weapon to counteract such performances. Where heavy weight assists efficiency, dimensions must not be starved. When fine shooting is in question the trigger pull must not be a bad dragging movement. If Lyman sights are liable to be used, the necessary screwthreads must be cut in the proper place at the top of the grip. Summarising all these conditions, we can at once see that a perfect design combining the requirements of the shooter with simple mechanical form is the first essential to a successful business.

Competition is so keen that we cannot afford to lose a single advantage that can be imparted by careful preliminary research. The rifle whose shooting can be improved 50 per cent. by carefully going over the mechanism and sighting, is obviously bad, and there are many such weapons on the market. If a trigger-pull has a long dragging movement, and it is found that the bent in the tumbler is three times as deep as is necessary, we know at once that improvement in this respect need not add to the prime cost of production. In a similar manner deficient length of barrel may bring the back-sight so near the eye as to spoil its definition in the act of alignment. Then, again, sights that are of bad optical design interfere with success when everything else may be right. All these individual points of design were recently brought prominently to our notice when we were asked by an important official in rifle club circles to name the best club rifle for use at 25 yards. We found it impossible to name any single weapon which in our opinion fully meets the needs of the shooter. We could have named several which can perform good work subject to slight additions and alterations that would cost very little to carry out. Nevertheless, these alterations involve hand labour of an exceptional character, in so far that the dexterity of the mechanic requires to be combined with the skill of the shooting expert. It is only in a well-organised factory that these two branches of achievement can be obtained in a weapon upon which little or no hand labour is lavished. Design must take the place of the tinkering which a well-informed shooter can apply to his own weapons; and what we should like to see is the same amount of excellence contained in the rifle as it is handed to the shooter from the packing case. Students of rifle club development must have noted the success of the service rifle when used in competition with miniature arms. This is to a great extent due to the circumstance that the service rifle, in spite of certain obvious defects which make it clumsy for miniature work exemplifies many of the markmanship qualities which are conspicuously absent in miniature rifles. The mere fact that the sights are well placed with reference to the eye, and that sling fittings are present goes a long way to help this rifle when competing with miniature weapons not so favourably disposed. The Proof House returns are but one evidence out of many that the methods of the gun trade should show more elasticity than is at present apparent.

THE PRESERVATION OF RIFLE BARRELS.

DURING the past year or so our knowledge concerning the deterioration of rifle barrels has considerably increased, and much of what has been learnt tends to indicate the kind of precaution that should be taken to minimise the injury due to storage. Of the many thousands of weapons which undergo deterioration in the course of use, probably not less than 80 per cent. are injured through lack of taking prompt measures to neutralise the injurious action of the solid and other products of combustion. The interior of a rifle barrel suffers from rust to an extent far greater than almost any other kind of polished metal surface. A pair of fire-irons which may be neglected year after year may be restored to perfect condition with very little scouring of the surface. In fact, unless positive rust has developed there is no appearance of definite pits. A barrel on the other hand often shows signs of rust after the shooter has taken every precaution within his power to produce a perfectly clean barrel. We accordingly find in the rifle barrel a tendency towards the formation of rust which cannot be satisfactorily accounted for by the dirt-retaining corners and angles due to the rifling. It is generally supposed that the fouling left in a barrel must have an acid reaction to account for the damage that occurs, but this assumption does not cover all the observed facts, because powders that produce an alkaline residue are also subject to the same defect. If Cordite is fired in an ordinary barrel, and the bore is filled with distilled water, chemical analysis shows that distinct traces of acid have been taken up by the water; but acid will not produce rust, and the trouble with rifles is largely exemplified by the presence of red rust on the cleaning rag. When acid combines with iron it produces a salt, whereas true rust is due to a combination of iron with carbonic acid gas. There is no doubt that acid might injure the barrel in another way, but we are apt to be led to a wrong conclusion if we attribute to the presence of free acid the whole of the trouble which we experience. Acid is certainly produced in considerable quantities when an explosive such as Cordite is only partially burned, leaving fragments of semi-consumed powder in the barrel. It is, however, the aim of the ammunition manufacturer to burn his explosive at a sufficiently high pressure to ensure its complete combustion.

Hitherto our treatment of dirty rifles has mostly consisted in scrubbing the bore with an oily piece of tow or rag, with the idea of stirring up the fouling so that it may be removed by a succession of dry patches. Everyone who has used cordite rifles has found that this treatment is not sufficient to counteract subsequent formation of rust, and the gunmaker found out long ago that the only safe treatment was to pour a kettle of boiling soda water through the bore. After this treatment the rifle may be dried and greased, being then safe for putting away for a considerable period. It is quite obvious that we have been working on a wrong principle all this time, but general practice does not appear to have focussed on any reliable specification of cleaning. The efficacy of soda is certainly recognised, and nearly all cleaning oils are supposed to contain a certain proportion of this ingredient. Soda is not, however, a material which can be suitably held by grease. It is always liable to combine with the vegetable or animal fat contained therein, and to lose its character by forming soap. If the grease is a pure hydrocarbon this action will not arise, but even then soda in combination with mineral jelly suggests to one's mind the idea of a watch dog muzzled and gagged so as to be of no use. While the chief function of soda seems ostensibly to be the neutralisation of acid, chemical knowledge tells us that it has the further virtue of attacking carbonic acid gas and thereby depriving it of its power of causing injury. Another virtue which it possesses is that when held in a water solution it combines with and renders harmless the water which is so frequently condensed in a gun or rifle barrel after firing and at other times. A perfectly dry rag will often emerge wet from the barrel, and if this moisture is charged with soda its power of causing injury is taken away.

This general statement of the *rationale* of rifle barrel cleaning will serve as a means of explaining the specia virtues which we are inclined to attach to the rifle cleaning preparation which is mistakenly called "Fluor Oil." We speak with the experience of six months constant use of this material in a variety of barrels, some of which had been allowed to get into a state of very serious neglect. No matter what time and trouble was taken in cleansing the bore a constant growth of rust showed the deep-seated nature of their bad condition. When Fluor Oil was applied the rusting action appeared to cease as if by magic, and the scrubbing action of firing appeared to produce a scouring of the surface which gradually removed the rust that had caked on the surface. Nothing would of course restore these barrels to their original perfect condition, but the fact remains that their shooting qualities have distinctly improved since the constant growth of rust in the bore has been stopped.

A peculiar convenience in the use of this so-called oil is that all the scrubbing and cleaning of the old days is entirely dispensed with. In fact we should be inclined to re-christen this preparation "the lazy man's cleaning fluid." All that is necessary after firing is to dip an ordinary bristle brush in the solution and pass it up and down the barrel a few times. There is no need to clean the bore in any way, and in glancing down the barrel it is apparent what a peculiar affinity the fluid has for the metal of the barrel. It seems to have spread itself over the surface with such clinging tenacity as to give it almost the appearance of a smooth bore.

Although the instructions on the bottle say that the rifle should be properly cleaned out three days after using the preparation, we have not found this necessary. The gummy nature which the fluid takes on may be remedied by a fresh application of solution; but rust does not according to our experience form even after weeks of storage. The peculiar virtue which we attach to the preparation is that it does not contain one particle of oil in its composition. It is mainly a water solution of a suitable form of soda. Special materials are added to check evaporation and in other ways further the object in view. The chemical composition is we believe due to Dr. Hodgkinson, the well-known chemical authority on explosives, working in collaboration with Capt. Hardcastle, who brought practical rifle knowledge to bear on the subject. Our reason for dealing so fully with a seemingly unimportant proprietary article is that we should like to see a large number of our readers purchase sixpenny bottles from Mr. Steward in the Strand, with a view to repeating our own small experiments on a larger scale.

FACTORY LOADED CARTRIDGES.

WHILST the policy of most of our cartridge and powder factories is directed towards the development of the so-called factory loaded cartridge, the interests of the gun trade are naturally averse to such a programme. All kinds of influences are held to be responsible for the change that is taking place, and the various parties concerned are from time to time blamed for the course events are taking. First, it is the powder maker who desires, in the face of storage restrictions, to make a market for his product. Then it is the ammunition manufacturer who supplies loaded ammunition for so small an extra charge over and above the cost of components. Finally, those who advocate a high standard of loading are supposed to be educating the public into the belief that this standard can only be achieved in the loading factory. There is a little truth and a good deal of fiction in the arguments that are used by those who object to the present line of development. Yet, from our point of view, the whole situation is caused by the inexorable laws of supply and demand. The level-headed dealer must never omit from his calculations the circumstance that the public is benefited in direct proportion to the smallness of the charge for which the middleman can distribute the goods of the manufacturer.

In reading old books on shooting, and when conversing with sportsmen of a former generation, it is almost invariably found that the old tradition about the cartridge requiring to be suited to the gun has given place to quite a different set of ideas. Formerly it was supposed that every gun had about it certain peculiarities of boring, chambering and choking, which made one particular charge more efficient than any other. Gunmakers themselves believed that by regulating and adjusting a gun for a given load, they were approaching nearer to perfection than would be possible if the gun were manufactured without reference to the particular combination of charge that was to be used in it. There is, it seems, a good deal of unsound scientific principle in such an opinion, since the investigations which have been carried through by the powder manufacturer have thrown an altogether different light on the question. It is not the fault of any particular set of individuals which has caused the growth of a belief that an ordinary well-made gun will do proportional justice to any properly loaded cartridge that is used in it. As this idea gains strength and acceptance, so the necessity for hand-loaded cartridges has diminished. It is not certain that those who advocated special regulation of the gun for a given charge were entirely sincere in their holding of such a faith. At any rate modern methods of gun boring have shown us that the best specification of barrel is the one that will do the greatest all-round justice to the various kinds of cartridges that are likely to be fired from it.

If we assume that even now every gun possesses certain peculiarities which make one particular load better than any other, modern knowledge tells us that ths desired combination cannot be ascertained by mere plating at the target. In fact, such experiments are from time to time conducted at the laboratories of powder companies in the interests of some individual sportsman, whose position and influence secure for him special consideration. The series of tests which are conducted with such an end in view would, if paid for at a fair market price, cost little less than a ten-pound note. It is accordingly clear that the general run of sportsmen must be satisfied with a cartridge which has not been specially selecte with reference to a particular gun. In this respect, therefore we see that the hand-loaded cartridge is not essentially superior to the brand that emanates from the factory.

There are, of course, a large number of sportsmen who favor some particular load, and they are likely to give their orders where there is every certainty that the desired conditions will be observed. A certain amount of cartridge loading is thus useful in avoiding the necessity of stocking an unwieldy number of differently loaded cartridges.

The gunmaker who lays himself out to load the bulk of his yearly sales of ammunition is naturally dissatisfied with the small profit that accrues. The standard of prices in any given district is set by the cutting dealer who supplies a sound cartridge for a moderate price. To load cartridges for the same sum of money leaves little or no margin of profit to cover the extra trouble involved. The gunmaker accordingly feels wroth when he finds that his skill and experience in cartridge loading possess so small a market value. On the other hand we do not see what remedy is available. In the first place it is a misnomer to draw any hard and fast distinction as between so-called hand-loaded and factory-loaded cartridges. The only difference is one of degree, and in many instances there is no distinction as between the methods observed for the two systems of loading. The gunmaker is supplied with a standardised powder, and he exercises all possible skill to ensure the correct measurement of charges, the selection of a suitable combination of wadding, the insertion of the right charge of shot and the closing of a well-filled case by a neat and workmanlike turnover. Such a cartridge is not essentially different in any material respect from so-called factory-loaded ammunition. In fact the greater the business of the gunmaker the more closely do his methods reproduce those of the factory.

If we take the case of two gunmakers conducting a precisely similar business, the one selling cartridges which are supplied ready loaded, the other doing the whole of the loading on his own premises, the cost of the complete article in each instance will be approximately the same, though, of course, the gunmaker who has a cartridge-filling department will find his time much more fully occupied than his fellow-gunmaker who has everything done for him. In a district where it is known that the local gunsmith is an expert in cartridge loading, he may make no more profit on selling a thousand cartridges than his fellow-trader who buys from the factory, but it is quite possible that he will maintain a larger turnover by reason of the fact that whatever good points his ammunition may have it is he alone who can supply the particular brand. Conversely, if he sold cartridges bearing the factory imprint, there would be nothing in them which the purchaser could not equally well obtain elsewhere. While, therefore, the question of cartridge prices responds to the laws of competition, which no individual can control, it must be understood that the reward for careful and conscientious labour is still to be earned. That this reward is not as encouraging, as in the days when higher prices were the rule, must be ascribed to the action of various individuals who have endeavoured to secure the profits of a large turnover by reducing the percentage of profit.

THE COMING FASHION OF LIGHT LOADS.

IT is an open question whether the title adapted for this article is not something of a misnomer, since the use of small shot charges in the 12-bore gun has been a marked development for some considerable time past. To a shooter who is possessed of a light and well-balanced gun, and who enjoys a sufficiency of practice to become expert in its use at driven game, the presence of a full charge of shot is more a disadvantage than the contrary. The timing of his shots is frequently disturbed by the fear that the game may be spoilt by receiving the highly concentrated charge at too close a range. Low flying birds approaching the shooter are frequently shot just before they attain their nearest position. Hence there is always the danger of spoiling a certain proportion of the bag for table use. As this is against the canons of good sportsmanship, the shooter will welcome any alteration of the charge which, while diminishing recoil, will thin out the pellets so as to increase the zone within which shots may be taken.

The modern driving gun, with its small amount of choke at the muzzle is exceptionally well suited for a cartridge that contains a small charge of shot. If the powder is burnt under favourable conditions, a sufficient pressure is developed to impart enough additional velocity to the pellets to improve their individual striking power, and thereby increase the chances of long-distance successes, while keeping the pattern thin at the nearer distances. One ounce of shot is the minimum that can be used with advantage for ordinary brands of smokeless powder, that is to say, powder which is standardised for the 1⅛ oz. charge. It is possible in many instances to make up a cartridge with even less shot than the amount here stated, provided the gun is so bored as to give satisfactory patterns; but there is always the danger that the centre of the area covered with pellets will be a little hollow, and it is to get over this difficulty that a new composition of powder has been introduced

This, while giving a sufficiently high pressure in the absence of the confining power of the full charge, is loaded into a cartridge case with a cone base, the idea being to obviate the necessity for using an unduly long column of wadding. The half-inch of felt which accompanies the one-ounce charge in the nominal 2½-inch case appears to be the maximum amount allowable, consistent with good patterns. A larger quantity of wadding seems to possess the characteristic of forcibly pressing into the cluster of shot as it leaves the muzzle and sending it flying at such an angle of spread as to leave the patchy centre which is characterised as cartwheel. Though the Americans use a very large column of wadding between the powder and the shot, it is quite possible that their practice is inapplicable to English conditions, in view of the different material of which the wads are made and the different relation of strength that exists as between the cap and the powder charge. Moreover, in that country they seldom go below the amount of shot charge which ensures a sufficiency of confining effect on the powder. We must, therefore, be satisfied to work out the desirable conditions for the new type of cartridge without seeking to derive information from precedent and from the practice of other countries.

When we find the 12-bore shot gun adapted for cartridges carrying the 16-bore charge we are faced with a somewhat peculiar condition of affairs. There are those who uphold the advantages of the 16 and 20-bore gun as far and away superior to the 12-bore when small shot charges are in question. Although experiments with the smaller shot gun bores have not been conducted during recent years, the tests which have been made in the past in scientifically conducted laboratories have almost invariably shown a very great difficulty in combining the essentials of pattern and velocity. The one or the other seems fatally inclined to sink below the level at which efficiency can be expected. And yet year by year we come across shooters who swear by their 16 and 20-bores, all the while that tests of their ammunition fail to justify the unmeasured praise that is bestowed. In the 12-bore this difficulty does not arise when sufficient skill and special knowledge are imparted to the building up of the cartridge. The powder maker is rapidly acquiring so much special knowledge of his product that if we give him a new specification he has little difficulty in producing the exact combination of properties that will comply with the needful requirements. In the case for instance of Messrs. Curtis's & Harvey we were lately privileged to witness some experiments with a special powder which they have manufactured for use with a 7·8ths oz. charge in a 12-bore cartridge. Using the ordinary cap and a cone-base case they were able to maintain, not only a sufficient level of chamber pressure, but also a well-maintained evolution of gas during the subsequent movement of the shot. The result was that the above charge was propelled with a velocity of 1,100 feet per second. Unlike such a high velocity in the case of a larger charge of shot the general pattern characteristics appeared to be excellent. Shooting at 30 yards, instead of the usual 40, a distribution of pellets was obtained that left nothing to be desired, from the point of view of evenness and absence of useless outlying groups, far away from the line of aim.

Such a powder is likely to carry us a stage nearer the realisation of a successful 7·8ths oz. cartridge. Eley's Litemode will undoubtedly gain in popularity by reason of the acceptance of its underlying principle by an important firm of powder makers. That the sportsman will in due course benefit from this change may be inferred from the special applicability of this combination with small shot for early partridges and grouse and with large shot for rabbit shooting. Although we have witnessed very important developments in the sporting cartridge the problem of a suitable rabbit loading has never been completely solved. What we want is a comparatively wide spread and thin pattern with sufficient driving power to produce successful results when long shots are taken. The large body area of the rabbit and the pheasant suggests the use of a comparatively large size of shot. To ensure a sufficiency of spread and to impart effectiveness to the single pellet it is necessary that the velocity should materially exceed that of the more fully charged cartridge. This is given with a powder that can combine a 1,100 f.s. velocity with a pattern that does not reproduce the evil characteristics of the cartwheel. In view of the experiments to which reference has already been made we feel that we can safely announce that we are within measurable distance of achieving a satisfactory short-distance cartridge without falling back upon the somewhat doubtful expedient of the shot spreader. Whether or not the introduction of lightly charged high velocity ammunition will involve the use of rather more choke in the barrel than heretofore is a question that can only be settled by the joint efforts of the sportsman and the gunmaker.

ROUND THE TRADE.

Mr. Henry Atkin is removing from his present address in Jermyn Street to new premises, No. 41 in the same thoroughfare.

We are informed that Nobel's sporting Ballistite was used by the winner of the Grand Prix de Turin and the Grand Prix d'Italie.

Nobel's Explosive Co., Ld., have sent up a copy of their new season's trade list for Ballistite and Empire loaded sporting cartridges.

Mr. H. J. Poulter has issued from his new address, 171A Midland Road, Leyton, Essex, a preliminary issue of his target catalogue for 1905.

The Explosives and Chemical Products Co., Ld., has been formed to carry on a business in explosives, ammunition, and chemical products with a registered capital of £50,000.

The summer season of the Gun Club is now about to commence, and the introduction of several new features should add interest to the meetings which are held three times a week.

David Thom & Co., Ld., has been formed to acquire the business of David Thom, Domeier & Co., Ld., and carry on the manufacture of sundry chemical substances amongst which "explosives" are included.

The directors of Holland & Holland, Ld., after placing £2,000 to reserve have declared a dividend on the ordinary shares at the rate of 11 per cent. per annum for the half year ended December 31st, making 9½ per cent. for the whole year

The usual routine business was transacted at the annual general meeting of the Gunmakers' Association held on the 27th ult. To consider future arrangements with regard to the resignation of the secretary a sub-committee of three was appointed.

Mr. A. R. Rickarby writes with regard to our notice last month of his book on miniature rifle shooting, that he has not been connected with the Ashford rifle club since October, 1903, he being hon. secretary of the "Ashford Church House Rifle Club."

Wilkinson's Stores, Ld., is the name of a newly registered company, which has been formed to adopt an agreement with Mr. T. D. Challoner and Mr. T. C. Wilkinson for the acquisition of the ironmongery and gunsmiths business carried on at 8, Sadler Street, Durham.

Sir Charles Ross recently showed us a foresight composed of white metal, which can be cast by the thousand to within minute limits of variation. Being made without hand labour, and at an infinitesimal cost, there is reason for believing that it meets a need of which riflemen have always felt conscious.

The Army Council has directed the issue of instructions respecting the new pattern sword for the cavalry which has recently been under trial. The sword in question is principally designed as a thrusting weapon, but will also admit of the cut being used as an additional mode of attack.

Messrs. Ludw Loewe & Co., Ld., of 30 and 32 Farringdon Road, E.C., have forwarded to this office their catalogue of special tools, machinery, gauges and other appliances for use in the machine shop. Even to those whose use of machinery is limited many of the tools and appliances illustrated will be in constant demand.

The report of the British South African Explosives Co., Ld., shows profits which provide for the payment of 4½ per cent. dividend as against 3½ per cent. for the previous year. As the financial year ended on October last the period involved does not fully cover the improved conditions incidental to the use of imported labour in the mines.

"A good shot will not handicap his skill by using a second-rate cartridge; only the best for him. Best quality only in steel-lined English cases." These sentiments met with our entire approval. They form part of an advertisement in the *Gamekeeper*. It appears, however, that these "best English high-class cartridges" can be obtained at 6s. 6d. for 100, carriage paid, or 30s. for 500.

The directors of the Nobel-Dynamite Trust Co., Ld., having received particulars of the earnings of the subsidiary companies, recommend the payment of a dividend for the year ended April 30th on the ordinary shares of the company at the rate of 8 per cent. and a bonus at the rate of 2 per cent., both free of income-tax, placing to reserve account £50,000, and carrying forward about £5,000.

According to a circular issued by Mr. Thomas D. Challoner, of 22 Dean Street, Newcastle-on-Tyne, it was decided at the meeting held recently in London to form an association for the protection of the gun and ammunition trade for the United Kingdom and Ireland to be called "The British Gunmakers' and Allied Trades Association." The chief interest about the circular is the suggestion that Ireland is not part of the United Kingdom.

The catalogue of the Nuremberg ammunition works of the Rhenish-Westphalian Explosives Co., Ld., has been sent to us by Mr. C. G. Mueller, the sole agent for this country. The firm's ·22 cal. rim-fire ammunition is rapidly obtaining a reputation for accuracy. The old trade mark of a U on the base is now replaced by the letter R, the Company being no doubt desirous of avoiding confusion with U. M. C. brand cartridges bearing the same letter.

The financial papers have not offered a very cordial welcome to the Rexer Arms Co., Ld., which, as one them points out is rather suggestive of a house of refreshment. The capital is fixed at £105,000 divided into 100,000 shares of £1 each, and 100,000 deferred shares of 1s. each. After payment of 10 per cent. divided on the ordinary shares and a certain percentage to the directors, the deferred shares divide the surplus profits with the ordinary shares. The company pays promotion and underwriting expenses, and the only business in sight appears to be the sale of some guns to Mr. Henry de Morgan Snell, one of the promoters.

The report and accounts of the Hotchkiss Ordnance Co., Ld., show a profit of £47,639 for last year, which gives with the carry-forward £48,022 available for distribution. This permits the payment of interest on debenture stock, the transference of £1,500 to the sinking fund, a 5 per cent. dividend on the preference shares, 2½ per cent. on the ordinary shares, and the appropriation of £19,399 for extinguishing the "Automobile suspense accounts" now standing as an asset on the books of the French Company, leaving £4,887 to carry forward. It is to be hoped that the increased activity of business of which the report bears evidence will be maintained.

The report of Messrs. Curtis's and Harvey, Ld., for 1904, states that the directors regret that competition in the colonies, mainly due to importations from the Continent, is still very keen, and that the heavy duties on explosives imported into the Transvaal and Orange River Colony render profitable trading in these places impossible. The result of the year's trading, after payment of debenture interest and other charges, is a net profit of £11,899, which, added to the amount brought forward, makes a total of £19,593. This sum it is proposed to appropriate as follows:—To set aside to reserve £2,000, to write off War and Sporting Powder Company's purchase account £500, to declare a dividend of 2½ per cent., £11,450, and to carry forward £5,643.

The report of the Morris Aiming Tube and Ammunition Co., Ld., for the year 1904, states that after charging the debenture interest, the accounts show a profit of £6,872, which, added to the amount brought forward, gives a sum of £7,780. The directors propose to provide £2,833 as depreciation on plant, machinery, buildings, &c., and to pay a dividend of 10 per cent. per annum, leaving a balance to be carried forward of £447. An interim dividend of 5 per cent. was paid in November last on the £40,000 of the then issued share capital, and there remains a further 5 per cent. payable on £50,000, the present share capital of the company. The value of the item for patents, &c., has been so considerably written down that it is not deemed advisable to make further reduction in the present assigned value.

BROWNING MUSKET BARRELS.

By R. B. Prosser.

Under the heading "Brown Bess" in the *New English Dictionary* we read: "The name familiarly given in the British army to the old flint-lock musket. *Brown Musket* was in earlier use: both names existed long before the process of 'browning' the barrel (introduced in 1808) and apparently referred to the brown walnut stock." The date of the introduction of "browning" is no doubt given on the authority of a paragraph in the *Times* of the 3rd October, 1808, p. 3, col. 4, which runs as follows:—

"The practice of polishing the muskets which in some regiments has been carried to such an excess as to materially injure the piece and render it totally unfit for use in half the time estimated for fair wear in usual service is to be abolished. Firelocks upon a new principle, with brown locks and barrels, have been already issued to the light companies of several regiments; and the Board of Ordnance have received orders to complete the issue to the remainder of the army with all the expedition possible, in consequence of which a requisition has been made of the gunsmiths in the several regiments stationed in the home district, to repair without loss of time to the Royal Manufactory of Arms at Lewisham."

This appears to be absolutely conclusive, and no one can blame the learned editor for relying upon it, but, as a matter of fact, the practice of browning musket barrels, if not actually introduced into the service, was at all events talked about more than 30 years before. On the 28th February, 1772, Viscount Townshend, then Lord Lieutenant of Ireland, writes to the Earl of Rochford, Secretary of State, as follows:—"In obedience to His Majesty's Commands signified to me by your Lordship in your letter of the 20th of December last I have sent by Lieut.-Col. Smith, my *aide-de-camp*, who will deliver this to your Lordship, two musquets and bayonets browned, and Colonel Smith will give your Lordship an account of the process, &c., as desired by the Surveyor-General of the Ordnance.—I am, &c., (Signed) Townshend."

The next communication is dated 14th March, 1772, when the Earl of Rochford sends to General Conway, Lieutenant-General of the Ordnance, the following:—"Having received from the Lord Lieutenant of Ireland, two Musquets and Bayonets browned, as also an account of the Process of the Browning, &c., and of the Improvement upon the Pan and Lock of a Firelock, I have the King's commands to send you the Musquets and Bayonets and to inclose to you the two Papers on the Subject, and to signify to you His Majesty's Pleasure, that you take the matter into your consideration and report to me your opinion thereupon for His Majesty's Information."

The inclosure referred to in the previous letter is endorsed: "The Process of Browning a Firelock and its Price," and runs as follows:—"The preparation or liquids is to be laid on the Barrells with a bit of linen rag in the same manner as a Barrell is rub'd with oyl to prevent rust, which in two days compleats the brown of an equal shining colour fit for service, without any assistance of heat or any other matter whatever that can be of prejudice to the Barrell.

"As any metal will wear by friction, so must the best and hardest brown colour it's possible for a Barrell to have, so far as the sockett of the bayonett reaches, which however may be greatly prevented by having the socketts bored smoother than has hitherto been found necessary, by the rough edges remaining from the file being taken off and the inside of the sockett browned.

"I have found by tryal and experience that the brown cannot be wore off or destroy'd except by such means as would offend or wear the very Iron, and as the Barrells will be sometimes liable to receive damage which in order to remedy immediately and to prevent every inconvence arising from the secret and methods not being universally made known: By each regiment having constantly delivered to them a small quantity of the necessary liquid with proper directions, any soldier can repair the damaged part without the least difficulty, so restoring all parts to an equal colour.

"The Barrells are by this brown colour effectually preserved from rust either in being exposed to the weather or by being laid up in magazines for any number of years. Whatever number may be required, from one hundred to a thousand or more, by employing a sufficiency of hands may be browned in two days. To have the locks more conformable to the barrells they must be left with the case hardening colour, as is the pattern fire lock, which will prevent the damage they now receive from the constant occasion of taking them asunder to polish them (the soldiers not having the proper method or conveniences to do it without injuring them) and renders them as uniform to the colour of the Barrells as possible, and as it will be found most serviceable and expedient to have them.

"I undertake to brown them at one shilling for the Barrell, Bayonett and Rammer.—(Signed) Lend. Alley, Gunmaker, Dublin."

The foregoing letters are preserved in the Record Office, the first being contained in a volume lettered "Ireland, Vol. 441, No. 24," the other being in the "Home Office Ordnance Warrant Books," Vol. 2, p. 278. A search in the Ordnance Papers might perhaps be rewarded by further discoveries. I will conclude by observing that the earliest recorded use of the phrase "Brown Bess" occurs in Grose's *Dictionary of the Vulgar Tongue*, 1785, where we read: "To hug brown bess: to carry a firelock, to serve as a private soldier."

The report and balance sheet of the Schultze Gunpowder Co. Ld., for the year 1904 shows a profit, after charging all current expenses and providing for bad and doubtful debts, of £8,325, which, with the balance for last year makes a total of £9,298. Of this amount £7,307 has been distributed in dividends to preference shareholders, and £1,029 has been written off the expenses account in connection with the debentures. The balance of £962 will be carried forward. Mr. Archibald Stuart Wortley has resigned on account of ill-health from the board of the Company. Accompanying the balance sheet is a statement giving notice of an extraordinary general meeting of the Company which was held on the 19th ult. This meeting was called for the purpose of reducing the capital of the Company by £88,630 which is approximately the amount of depreciation which the Company's assets have suffered by the total failure in regard to the closing of the Smokeless Powder Company's factory at Barwick and the practical liquidation of that Company's business. The scheme was duly approved, and it involves reducing the Company's capital from its present £445,000 to £323,400.

LECTURES TO YOUNG GUNMAKERS.

XXXIV.—THE ACTION OF WIND ON RIFLE BULLETS.

THERE is one question in connection with rifle gunnery which we have consistently shirked because of the mathematical difficulties incidental to the proper elucidation of the subject. The *Text Book of Small-Arms*, for instance, devotes an immense amount of space to the consideration of the influences affecting the bullet after it leaves the muzzle. In perusing the chapter in question, we find so many subjects are touched upon that the actual influence of the wind in deflecting the course of the bullet is not sufficiently fully stated to give the reader a clear understanding of the forces in operation. We recently had the good fortune to meet Capt. J. H. Hardcastle, R.A., at the long ranges at Bisley, and in the course of a discussion concerning wind allowance, as applied to the match rifle, we discovered that he happily combined a theoretical and mathematical knowledge of the question with constant examination of practical results as recorded in his score book. He kindly consented to formulate his views for use by us as the basis of this lecture.

Whether the place be the rifle range, the gun room of a rifle club, or the dining room of the deerstalker, theories concerning the method of action of the wind on a bullet in flight are ever under discussion, but they are never brought to a satisfactory conclusion. The scientific explanation can be set down in a very few words of simple English; but it is generally a matter of half-an-hour's talk to convince the questioner that the scientific explanation is really simple and straightforward, and does not contain an erroneous assumption. Although any experienced shooter can decide by a moment's examination of the weather what is the practical allowance which must be made for wind deflection, it is not surprising that he should be at a loss for the why and wherefore that underlies his decision. His knowledge of dynamics is as a rule very small, but his experience of rifles and atmospheric effects is large and not to be lightly contradicted. It is precisely to this prolonged experience that it is proper to appeal as an introduction to the dynamics of the matter when writing for the information of practical men. In just the same way, when endeavouring to satisfy the doubts of a mathematician, it is proper to use the symbolical argument of a series of equations. Each man understands the force of his own method of expressing his ideas, and each rightly insists that the line of argument should be sound and should account for all the known facts. The scientific explanation has at least the recommendation of extreme brevity. We will accordingly state that side of the question first.

The solution of the problem is considered by Prof. A. G. Greenhill, F.R.S., to be due to the late Capt. F. Younghusband, formerly Superintendent of the Royal Gun Factory at Woolwich, and is to be found on page 160 of the *Text Book of Gunnery*, 1902. It is further explained in the *Journal of the U.S. Artillery*, in the issues of January, 1900, and May, 1903. The resulting formula is very nearly

$$x = \frac{V \times R}{C \times 14}$$

Where x is the required allowance in minutes of angle.

V is the velocity of the wind "across" the range measured in miles per hour.

R is the number of hundreds of yards in the range.

C is weight of the bullet in pounds divided by the square of its diameter in inches.

14 is a constant numerical factor.

This formula, which is true for the ·303 bullet as fired from the service rifle, will be found in a slightly different form on page 241 of the *Text Book of Small-Arms*, 1904.

The scientific explanation translated into plain English is not difficult to grasp. The spinning bullet behaves as a gyroscope, which in fact it is, but in order not to spoil our lecture by assuming too much knowledge on the part of the reader we will explain the particular gyroscopical evolutions which are performed by the bullet. When the bullet first leaves the barrel it encounters the wind, and because it is spinning it behaves in a special way. The rotation around its longer axis gives the bullet a peculiar power of resisting any movement of its axis of spin. It must, however, take account of the pressure of a current of air coming from the side. Being a gyroscope, it finds a position of stability by turning the axis so that the nose of the bullet is slightly inclined towards the direction from which the wind blows. The bullet, moreover, moves bodily with the wind, in just the same way that a balloon partakes of the motion of the air in which it is suspended. In the case of a bullet we accordingly have a gyroscopic effect which causes it to travel up wind to a certain extent, and a bodily drift in the direction of the current which carries it away from its initial line of movement.

The analogy of a boat in a tideway will afford a useful but not complete illustration of this action. In rowing from the shore to a buoy, when the tide is running at right angles across the course, the head of the boat is set up stream, and while the course is a straight line between the shore and the buoy, the angular course of the boat through the water varies according to the relative rate of movement of the boat and the tide. In the case of the gyrating bullet moving through the air, the inclination of its axis towards the wind is the resultant resistance of the air. The first portion of this scientific explanation may safely be taken on trust by practical men. It is discussed in the article "Gyroscope" in the ninth edition of the *Encyclopædia Britannica*. The second portion contains the difficulty which puzzles the non-scientific reader, especially one who has never been up in a balloon.

It is only right to say in this connection that there are many who feel a difficulty in accepting in its entirety Capt. Younghusband's theory of wind deflection. His theory seems fully to account for observations of a practical nature. On the other hand, it is conceivable that another explanation might equally satisfy this requirement. Differences of opinion exist on the question as to whether the bullet adopts the motion of the air as quickly as a balloon or boat with their relatively greater surface and longer period of travel. The alternative view treats the bullet as a body having a certain surface and a certain weight, upon which acts a force represented by the wind, this producing an accelerating side of movement which does not equal that of the wind until a material amount of time has lapsed. Capt. Younghusband's theory, which we adopt because calculations thereon agree

with practice, and it is the view that is accepted by artillerists, assumes that the bullet so rapidly acquires the side movement of the air that no correction is necessary for the short distance of its travel during which the side movement is less than that of the air.

A balloon moves down wind at the pace of the wind, although its occupants are unconscious of any feeling of motion, except when the balloon is struck by a gust and has to "change" its motion. In that case they are conscious of some motion, because the balloon is not a rigid body, neither is their weight collected at the centre of gravity of the balloon. The motion they then perceive is the relative movement of the system about the centre of gravity of that system. This consists of their bodies, the car and the gas bag. A bird flying in the air and the occupants of a small boat in a tide-way are similarly only conscious of the movements caused by their own exertions or by gusts and waves. The steady motion of the air or sea relative to the ground beneath it is only apparent by looking at the ground. The motion of the earth round the sun was for centuries taken to be a motion of the sun round the earth, because we ourselves partook of the motion. Even now the man in the street cannot prove that the earth goes round the sun but believes it does so, because the nautical almanac and all the other predictions of astronomers based on this supposition are found to be exact and true. In other words the man in the street believes in the proverb "the proof the pudding is in the eating." The pudding in this case is the calculated deflection and the "proof by eating" is the comparison of calculated with observed results.

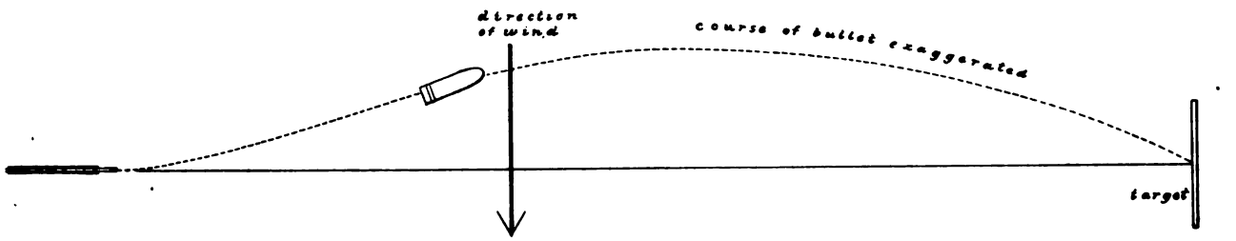
TABLE OF DEFLECTION IN MINUTES FOR A TEN-MILE CROSS WIND.

Range in yds.	200	500	600	800	900	1,000
·461	2·2	4·8	7·6	9·7	10·8	11·8
Martini	4·8	11·2	13·2	16·8	18·7	20·3
Lee-Enfield	2·9	8·1	10·0	13·8	15·4	17·4
Mannlicher	2·8	7·4	9·8	13·8	15 7	17·6

The above table of calculated deflections for target rifles is taken from the article by Capt. J. H. Hardcastle in the May number of 1903 of the *Journal of the United States Artillery*, and substantiates the following five conclusions which are the result of experience:—(1) The old ·461 Metford by Gibbs match rifle required much less deflection at all ranges than the Martini-Henry. (2) The Lee-Enfield requires more deflection for wind than the ·461, and at the long ranges this increase amounts to about 30 per cent. (3) The ·256 Mannlicher is affected by wind practically as much as the ·303 (4) The Martini-Henry at 200 yards is much more sensitive to wind than the ·303, but as the range increases this difference diminishes. (5) The old rule of thumb for the ·461 "give one minute at 800 yards for each mile per hour of the cross wind" was practically exact.

The observed effects of a cross wind on the projectiles of heavy ordnance, allowing for the increase of velocity of the wind at the great heights attained by them, also corroborate the correctness of the scientific explanation.

Taking the muzzle velocity of the Lee-Enfield to be 2,000 f.s. and considering a cross wind from the right of 20 f.s., and a time of flight for 1,000 yards of 2½ seconds, the projectile on emerging from the barrel into the cross wind turns its nose up wind at an angle whose tangent is 20-2,000 that is ·01, equivalent to 35 minutes of arc. It takes perhaps 20 or 30 yards to complete this turning motion, during which distance it performs certain gyrations about its mean trajectory. As soon as the resistance of the air has extinguished these unsteady motions the bullet goes to sleep with its nose pointing about half a degree up wind; that is to say with its spinning axis in line with the direction of the resultant resistance. It is then travelling freely in the air and partakes completely of the motion of the air relative to the earth, and as the air goes bodily down wind the bullet goes bodily down wind also with it, just as a submarine goes bodily down tide with the water, whether her engines are working or not. The air travels at 20 f.s. for 2½ seconds, and so moves 50 feet to leeward while the bullet is flying the 1,000 yards; but the bullet is moving at angle of 35′ up wind and so saves 35 × 10 inches or say 30 feet and strikes the butt only 50−30 feet = 20 feet down wind. The good target shot would have allowed about that distance for such a wind. If the shot were a bullseye, the plan of the trajectory over the ground would be curved so that its convex side was up wind, and the axis of the bullet at any point of the trajectory would point 35 feet up wind, so that viewed from the earth the bullet would seem to behave crab-wise and travel slightly sideways. The difficulty of stating with absolute precision just exactly what evolutions a bullet performs, arises from the virtual impossibility of conducting critical experiments which will give precise information. This must be our justification for having introduced into the theoretical aspects of this lecture certain assumptions which appear to contradict accepted theory in other directions. We must, however, give our allegiance to the theory which is for the time being accepted by artillerists, being at the same time capable of mathematical proof.



THE PROOF HOUSE STATISTICS.

IN the accompanying table we present a brief digest of the number of proofs which were made in Birmingham during last year. It will be seen on comparing the figures with previous records, that the only sign of improvement is in respect to military rifle barrels. There has undoubtedly been a good deal of activity in respect to private business with the service rifle, though we have no special information to show whether it arises from sales to rifle clubs, private members and volunteers, or whether the weapons have gone abroad.

	1902.	1903.	1904.
Provisional Proofs	**94,039**	**96,674**	**63,549**
Definitive Proofs—			
Muzzle Loaders	15,799	24,112	34,122
African Barrels..	83,640	109,158	69,661
Breech Loading Arms ..	87,485	100,416	71,347
Nitro Proof of Rifle Barrels..	1,571	2,435	2,270
Express Rifle Barrels ..	537	619	557
Military Rifle Barrels.. ..	4,635	4,157	8,177
Chambers of Revolvers ..	68,674	64,507	31,794
Pistols	923	597	160
Sundries	588	412	824
Supplementary Proofs—			
Nitro Proof	18,424	23,492	21,819
Proved with Nitros	473	895	689
	282,749	**330,800**	**304,969**

In provisional proofs we find a deterioration, the falling off being mainly accounted for by the 2d. proofs of twisted double and single birding and rifle tubes. Now that foreign materials are separately charged, we can see that there is a total under this heading of 2,896 barrels out of the entire 63,549 provisional proofs. The falling off of 30,000 muzzle-loading definitive proofs is explained by the 40,000 fewer African barrels that have been tested, the balance of 10,000 being accounted for by improved totals under other headings. In the matter of breech-loading arms there is a deterioration of 29,000 weapons, which is as nearly as possible 29 per cent. of last year's total. Of the 71,347 breech-loading arms proved, no less than 8,054 are entered as foreign, this representing as nearly as possible 11 per cent. of the total. Apparently the only other foreign proofs of breech-loading arms are represented by the 61 military barrels, which is indeed a small importation of foreign weapons. It is possible, however, that in this respect the Birmingham Proof House would get much less business than London. Foreign revolvers account for 1,192 out of the total 31,954 proofs in this connection. Under the heading of supplementary proofs we have a very fair index of the total number of better quality sporting guns, whose safety is made the subject of this additional test. The total 21,819 compares with 23,492 for 1903, and 18,424 for 1902. As this proof is probably applied each year to an increasing proportion of shot-guns sold in this country, it is possible that the falling off is greater than the figures would lead one to suppose. Consequently, we see in the circumstance of a reduction under this heading the most unfavourable aspect of the records for the year under consideration.

RETAIL CARTRIDGE PRICES.

KYNOCH LIMITED *v.* POLLARD & CO.

THIS was an action commenced by Kynoch Limited, of Lion Works, Witton, Birmingham, to restrain the defendants, Pollard and Co., of Worcester, from selling certain sporting cartridges known as "Bonax" below the price of 7s. per 100 net. Mr. J. J. Parfitt appeared for the Plaintiffs and Mr. Vachell appeared for the defendants.

In opening, Mr. Parfitt explained that Kynoch Limited, who were the sole manufacturers of certain sporting cartridges known as "Bonax," only supplied them on the condition that they should not be sold retail below the price of 7s per 100 net. On the 30th September, 1904, the plaintiffs received from the defendants an order for 4,000 "Bonax" cartridges. The cartridges were invoiced at the price of 8s. 6d. per 100, which with discounts reduced the price to the defendants to 5s. 7d. per 100, and the invoice for the cartridges was despatched on the same day, viz, the 30th September. At the bottom of the invoice was a printed notice in red ink as follows: "These cartridges are sold to you on the understanding that they shall not be sold retail below the following prices: 'Opex,' 11s. 6d. per 100 net; 'Bonax,' 7s. per 100 net; and acceptance of the goods shall be taken to be an acceptance of this condition." The invoice was received by the defendants by the first post on the morning of the 1st October, and the cartridges, which had also been despatched by rail on the evening of 30th September, were delivered about midday on the same day.

On receipt of the invoice no objection whatever was made by the defendants to the condition upon which the cartridges were sold; but on the 16th November plaintiffs received information that the defendants were selling them at the price of 6s. 6d. per 100, and that they were also advertising them for sale on cards and in their shop window at that price. The Company thereupon sent one of their travellers to Worcester, and he interviewed the defendants on the subject. He asked them how they came to be selling and offering for sale the cartridges at 6s. 6d. per 100, having regard to the fact that they had contracted with the plaintiffs not to sell them below 7s. In reply the defendants stated that they had bought the cartridges, paid for them, and intended to sell them at what price they liked. The plaintiffs' traveller thereupon reported the results of his interview with the defendants. The plaintiffs then took the matter up direct, pointing out that the defendants were committing a breach of the contract not to sell them below 7s., and they asked for an undertaking that the terms of the contract should thereafter be adhered to. No satisfactory reply having been received, the plaintiffs again wrote defendants on the subject; and in reply the defendants denied that they had bought the goods under any special conditions whatever, and asserted that they received the goods before they saw any invoice. The plaintiffs wrote in reply that there was no question that defendants had contracted not to sell below 7s., but they offered to take back the cartridges if the contract could not be kept. Failing this, the defendants were informed that if they sold any of the cartridges below the stipulated price of 7s., proceedings would be commenced for an injunction and damages.

Matters rested here until the 28th December, when the plaintiffs again received information that the defendants were selling and offering for sale the cartridges at 6s. 6d. per 100. They thereupon sent and purchased 200 of the cartridges at 6s. 6d. per 100, and placed the matter in their solicitor's hands. He wrote to the defendants asking for an undertaking that they would not thereafter sell below the price of 7s., and requiring them to advertise an expression of their regret at having so done in certain newspapers to be approved of by the defendants.

No satisfactory reply being received, the writ in the action was issued. Counsel contended on behalf of the plaintiffs that acceptance of the goods, following the receipt of the invoice containing the printed condition as to the retail price, constituted a contract by the defendants with the plaintiffs not to sell below that price, and asked for an injunction to restrain the defendants from committing a breach of that contract, and for damages.

Mr. Lockie having been called to prove the posting of the invoice, and the Midland Railway Company having been called to prove delivery of the cartridges, Mr. Arthur Chamberlain, the chairman of the Company, was called. In reply to Mr. Parfitt, he stated that the plaintiffs were the sole makers of the cartridges known as "Ronax." They were never sold without a contract to the effect that they should not be retailed below 7s. per 100, as appeared on the invoice. That was their invariable practice. The Company always took proceedings in case of a breach of contract, and quite recently they obtained an injunction against another trader.

Mr. Parfitt asked whether proceedings were taken as much in the interests of the purchaser, as of the Company, and reply was, "Quite as much; we take proceedings in the interests of fair dealing." The witness further explained that in connection with a proprietary article it is absolutely necessary that the retailer should feel that he is protected from under-cutting by his competitors. If he were not so protected sales would be reduced. Sales would have to be confined to a few special agents instead of being free to every retailer throughout the country who likes to purchase the goods.

Mr. Vachell, for the defence, submitted that there was no contract. The defendants were unaware that the plaintiffs imposed any restrictions on the sale of the cartridges. Counsel contended that defendants gave no assent to the condition attached to the invoice. He did not, in fact, accept the terms. More conclusive evidence of the assent to the terms was wanted than the mere fact that the defendant retained the goods. Defendant, cross-examined, said he considered all along he was a free agent; that, having paid for the goods, they were his own property. His contention was that he did not purchase the cartridges upon the terms alleged; and such terms were sought to be imposed by the plaintiffs after the cartridges had become his own property. Only 500 were sold at less than 7s. per 100.

His Lordship in giving Judgment said he had come to the conclusion that there was a clear contract by the defendants with the plaintiffs not to sell the cartridges in question below the price of 7s. per 100. He pointed out that the defendants admitted reading the invoice on receipt of it, and the receipt of the goods subsequent to the receipt of the invoice had been proved. He held that the receipt of the goods subsequent to the receipt of the invoice, which contained the stipulation that the goods should not be sold retail below the price of 7s., constituted a contract which the plaintiffs could enforce. With regard to the remedy, he held that he was not satisfied that the defendants had sold out of these cartridges as they alleged, and under these circumstances, he should grant the injunction asked for, also the declaration. Nominal damages were also awarded. His Lordship added, that when a man took up a line of this kind he must pay the costs, and he certified for costs on High Court scale.

The report of the American E.C. and Schultze Gunpowder Co. Ld. discloses the receipt of £3,750 by way of the dividend guaranteed by the Du Pont Company, on the £75,000 share capital. Of this £3,000, which makes 4 per cent. dividend, has been distributed to the shareholders, the remaining £750 having been appropriated for income tax charges, office and legal expenses, reserve and so forth, the shareholders thus obtaining 8 per cent. on the present market value of the shares, the same being guaranteed by an agreement.

TRADE MARKS.

ADVERTISED. APRIL 5—26, 1905.

269,591. A representation of Britannia, at whose feet is a target, and above which is the word BRITANNIA. C. G. Bonehill, Birmingham. To apply to arms and military stores—not explosives. January 26, 1905.

REGISTERED. MARCH 23—APRIL 19, 1905.

264,424. Braun & Bloem, Gesellschaft mit beschränkter Haftung.

APPLICATIONS FOR PATENTS.

MARCH 27—APRIL 22, 1905.

9,462A/04* Recoiling Gun Mountings. A. T. Dawson and G. T. Buckham. (Date applied for under Patents Rule 9, April 25, 1904.)
6,651* Explosives containing aluminium. H. J. Haddon (Agent for *G. Roth*).
6,672 Explosives. R. W. James (Agent for *P. Golovin*).
6,746 Projectile Fuses. H. B. Strange, H. T. Ashton and M. J. C. Dennis.
6,844 Automatic Small-Arms. T. R. R. Ashton.
15,322A/04* Targets. C. Chevallier and E. Cadet. (Date of application in France, August 14, 1903. An invention comprised in application No. 15,322, July 8, 1904.)
6,973 Ammunition Carrier. A. H. Corbet.
7,200 Single-Trigger Mechanism. J. W. Smallman.
7,420 Electric Gun Controller. The British Thompson-Houston Co. (Agents for *The General Electric Co.*).
7,723* Cartridge Loader. D. Larsson. (Date of application in Sweden, April 13, 1904.)
7,733 Target Apparatus. T. L. Jones and The Auto Electric Rifle and Target Co., Ld.
7,754 Small-Arms. J. H. Topham.
7,772 Rifle Range Marker. F. J. Brown.
7,799 Ordnance Sights. Fried. Krupp, Ag. (Date of application in Germany, May 30, 1904.)
7,882 Torpedoes. E. A. Jefireys.
7,933 Torpedoes. Sir W. G. Armstrong, Whitworth & Co., Ld., and E. W. Lloyd (Agents for *A. J. van Stockum*).
8,065 Armour Piercing Projectiles. E. Jones, and Kynoch Ld.
8,079 Automatic Small Arms. E. H. Olive and Sir W. G. Armstrong, Whitworth & Co., Ld.
8,115 Projectile Fuses. J. H. Rigbey.
8,284* Torpedoes. H. A. Noalhat and G. Fournier.
8,286 Ordnance Practice Rifles. A. T. Dawson and G. T. Buckham.
8,287 Ordnance Percussion Primers. C. Holmstrom, E. Middleton and G. A. Kohler.
8,290 Ordnance. C. Holmstrom, E. Middleton and G. A. Kohler.
8,426 Trigger Mechanism of Small-Arms. H., E. and T. Hammond.
8,552 Gun Carriages. C. Holmstrom, E. Middleton and G. A. Kohler.
8,562* Automatic Firearms. R. Frommer.
8,584 Air Guns. L. Jeffries.

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

MARCH 30th—APRIL 20th, 1905.

COMPILED BY HENRY TARRANT.

3,024 (1904). **Ordnance Practice Tubes.** A. T. Dawson and G. T. Buckham, London. A method of attaching an aiming or practice tube to the bore of ordnance and of ensuring protection from injury to the charge chamber or to the bore when introducing or removing the tube. The tube is detachably connected with the breech chamber of the gun and may be worked by its own breech mechanism. Accepted March 6, 1905.

3,029 (1904). **Ordnance Sighting.** P. Tsoucalas, Greece; and Société Schnieder & Cie., France. The device for correcting

the natural error due to "drift," instead of being fixed on the sight support is pivoted so that it is able to receive the combined action of two other devices adapted to correct errors due to wind and movement of the ship. An automatic total correction of all errors is effected through this device, no matter what the range may be. Accepted March 6, 1905.

7,218 (1904). **Field Gun Shields.** B. Behr, Germany. A shield for field guns adapted to protect the gun crew and the gun itself, consisting of two hoods rotably mounted upon the axle of the carriage wheels. The hoods surround practically half the wheels. When travelling they cover the upper halves of the wheels, but when the gun is in use they are turned down into vertical position. Accepted March 23, 1905.

7,219 (1904). **Field Carriage for Ordnance.** B. Behr, Germany. A field gun carriage, the axle of which is cranked both upwards and downwards to ensure greater rigidity. In order to decrease the strain imposed by the pulling of the horses on the axle and cheeks, the cheeks are so mounted by means of oblique slots that springs may be arranged to take the strains. Other improvements are dealt with. Accepted March 25, 1905.

7,770 (1904). **Shot Gun Wad.** G. Bathgate, Edinburgh. Instead of the ordinary felt wad in a shot gun cartridge a cylindrical cork wad is used. When firing, this pneumatic wad is said to yield before the shot moves the turnover, and by the cushioning effect so produced to diminish the jar on the shooter's shoulder. Other advantages are claimed. Accepted March 9, 1905.

7,991 (1904). **Miniature Rifle Target.** Maj.-Gen. Luard, Sevenoaks. A target for use in miniature rifle ranges adapted to be carried from the firing position to one behind a screen for the purpose of re-whitewashing, in which the scoring of bull's-eyes is visually indicated. The target is furnished with a hole constituting the bull. Behind the hole is a plate which is automatically oscillated when struck by a bullet. A disc is by this oscillation brought into view. Accepted March 9, 1905.

9,735 (1904). **Balanced Targets.** Capt. E. T. Humphries, R.E., Hythe. Two targets adapted to balance each other are provided on their sides at each corner with brackets in which rollers work. The rollers are adapted to engage the bottoms and sides of trough-shaped uprights and when the targets are pulled up or down to facilitate the movement. The targets are moved by means of a wire rope working over a pulley. Accepted March 30, 1905.

10,270 (1904). **Shields for Ordnance.** R. A. Hadfield and A. G. McK. Jack, Sheffield. The process of bending to form and cutting of port holes in gun shields is dispensed with by the use of a mould constructed with an interior of the same formation as it is desired the shield shall take. Nickel chromium steel of the kind described in Patent No. 16,132, 1901, is poured into the mould. When set the shield is annealed and hardened as set out in Patents Nos. 16,131 and 16,133, 1901. Accepted March 9, 1905.

10,565 (1904). **Field Gun Mountings.** A. T. Dawson and G. T. Buckham, London. A machine or automatic gun carriage of the tripod type in which the top carriage is adapted to be turned about its vertical pivot, independently of the traversing plate, by the pressure of the hand for rough laying or together with the plate by the traversing mechanism for fine laying. The top carriage and the plate are each carried by the same pivot and are provided with means for readily locking or unlocking them to or from each other. Accepted March 23, 1905.

12,871 (1904). **Telescopic Ordnance Sights.** Lieut. H. C. Mustin, U.S.A. This patent deals with the mounting of telescopic sights on guns protected by turrets. The sighting apparatus is so mounted that none of its connecting mechanism and only a small portion of the objective end of the telescope is exposed. The telescope used has an angular line of sight and may be adjusted relatively to the line of the bore. Many advantages are claimed for the method of mounting set out. Accepted March 23, 1905.

14,480 (1904). **Ammonium Nitrate Explosive.** N. Ceipek, Austria. Explosive compounds of the ammonium nitrate and aniline nitrate class, which are useful in fiery mines, are mixed with aluminium powder in order to enhance their shattering effect. From 10 to 15 parts of aluminium are mixed with from 90 to 85 parts of an explosive formed by mixing 85 parts of ammonium nitrate with 15 parts of aniline nitrate. Accepted March 16, 1905.

20,366 (1904). **Projectile Construction.** A. H. Emery, U.S.A. A shell, constructed with chambers for high explosives, is provided with a flat nose arranged to contain a comparatively large portion of the explosive. This formation is adopted in order to allow the explosive to be brought as near as possible to the target when the shell strikes. The base wall is thicker than that at the nose. Accepted March 23, 1905.

22,887* (1904). **Lock Mechanism for Three-Barrelled Guns.** J. Meffert, Germany.

28,376 (1904). **A Self-Combustive Compound.** Hudson Maxim, U.S.A. The production in the form of rods of a self-combustive compound capable of burning under pressure in a confined space for obtaining motive power for driving automobile torpedoes. The rods are formed by cementing together thin layers of colloidal explosive under pressure. Longitudinal flaws are by this method obviated. Accepted March 9, 1905.

28,777 (1904). **Ordnance Elevating Gear.** C. D. Abel, London (Agent for *Rheinische Metallwaren und-mf., Germany*). Elevating mechanism for high angle guns by means of which a combined apparatus effects either slow or rapid elevation. When applied to guns with toothed segment mechanism, both the slow and quick elevating movements are obtained by means of the toothed segment and the gear engaged therewith. Accepted March 30, 1905.

29,304* (1904). **Breech Locking Device for Small-Arms.** B. Balay and L. Seefehlner, Hungary.

29,433 (1904). **Sporting Guns with Fixed Barrels.** L. Charlin and J. Santoit, France. Improvements in the mechanism of the fixed barrel gun set out in patent No. 29,432, 1904, are dealt with in this specification. The hook-shaped projection on the barrel end is extended into the breech casing. The locking bolt engages this projection, and helps to obviate the strain which tends to turn the barrels to the right or to the left according to the barrel being fired. Accepted March 23, 1905.

3,554 (1905). **Detonator Fuse for Blasting.** F. Render, Manchester. In order to prevent the chance of misfire due to the flash not penetrating the hole in the copper ring in high or low tension blasting fuses, a compound electric detonator fuse is formed with a charge of guncotton powder between the firing charge and the annular disc which protects the main detonator charge. The powder carries the flame with certainty. Accepted March 30, 1905.

3,970 (1905). **Ordnance Brake Mechanism.** Fried. Krupp, Ag., Germany. An improvement in apparatus for securing the brake-cylinder to the gun barrel and for mounting the running out spring in ordnance with barrel recoil of the type described in patent No. 16,048, 1901. A considerably increased amount of the brake cylinder which may be used for reception of the brake liquid is utilised, and the vibration of the screw spindle is obviated. Accepted March 16, 1905.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

LOCK MECHANISM FOR THREE-BARRELLED GUN.

22,887 (1904). J. Meffert, Germany. A system of self-cocking lock mechanism for a three-barrelled gun is set out in this specification. The side locks are cocked, and are operated, much after the known method; but the mechanism of centre barrel, arranged above the other two, is cocked through the medium of a slide situated on the top strap roughly in the position usually occupied by the ordinary safety slide.

The drawings appended illustrate the mechanism. Fig. 1 is a side view principally of the cocked mechanism of the centre lock; Fig. 2 represents the right hand lock parts in the cocked position; Fig. 3 the hammer of the middle lock; and Fig. 4 the gear through which the centre hammer is cocked and through which the parts are turned, so that one of the side sears may subsequently be lifted.

The side hammers, of which the right hand one *a* is an example, are cocked in the ordinary way when the barrels are broken down for reloading. The centre hammer *b* is pivoted in the block *c*, and it possesses an arm *n* extending towards the rear of the action. On the end of this arm is a roller *d* which is engaged by the inclined surface *e* of the part *f*. The part *f* is pivoted in the trigger plate and its extension *g* is engaged by the lower recess in the slide *h* working in the action strap. When the slide *h* is pushed forward,

Fig. 1

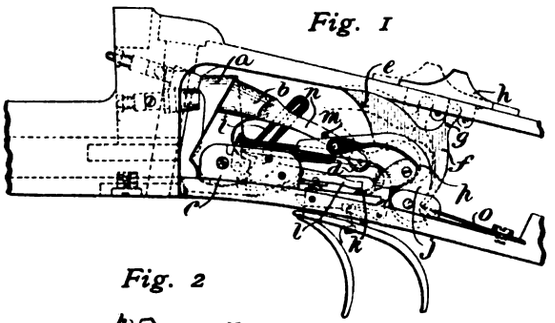


Fig. 2

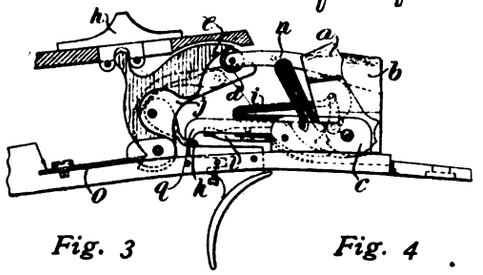


Fig. 3

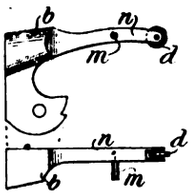
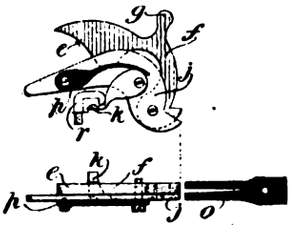


Fig. 4



the roller *d* runs over the surface of the descending part, and the hammer *b* is forced in this manner, against the pressure of the spring *i*, into its cocked position (Fig. 1). When the part *f* is turned down during this operation, the limb *j* is carried with it, and the tumbler *k* connected therewith is forced beneath the sear *l*. At the same time the limb *j* is carried beneath the projection *m* on the hammer extension *n*. When the finger pressure is removed from the slide *h*, the spring *o* turns the part *f* back to its original position, taking with it, of course, the slide *h*. The limb *j* is detained by the projection *m*, and the tumbler is held beneath the sear *l* by the spring *p* attached to the limb *j*. When the trigger is pulled, the sear *l* is lifted through the medium of the tumbler, and the hammer *b* is released to discharge the centre barrel. The release of the hammer removes the projection *m*, and the spring *o* operates to turn the limb *j* back to its normal position. When this occurs, the spring *p* forces the tumbler *k* further in to a position beneath the right hand sear *q* (Fig. 2) By this arrangement of the parts it is stated to be impossible accidentally to discharge two barrels at once; and it will be understood that the centre barrel is available when its use is necessary. The gun may be used at other times as an ordinary double-barrelled weapon. The hook *r* is fixed in a position between the sear to limit the distance through which the trigger may raise the tumbler, so that two sears cannot simultaneously be raised. Marking pins may be attached to indicate the position of the parts of each lock. Accepted March 9, 1905.

BREECH LOCKING DEVICE FOR SMALL ARMS.

29,304 (1904). B. Balay and L. Seefehlner, Hungary. The breech locking device set out in this patent may roughly be described as of the "interrupted screw" type, well known in relation with ordnance It is applicable, however, only to small arms possessing fixed barrels To quote the patentee—

"The hinge and bolt-closing actions hitherto used even when made in a very careful and precise manner, are insufficiently reliable in guns where modern nitrocellulose powder is employed, having a gas pressure almost twice as great as that of gases generated by black powder. The only part supporting the barrels, the hinge screw or the bolt is not sufficient to prevent the barrels from becoming raised from the false breech at the moment of firing, especially as the bolt merely prevents the barrels from turning, but by no means prevents the bending of the false breech which closes the barrels at the back and serves as a support for the cartridge. Lateral deviation is, besides, also not inconsiderable, as the strain acts outside the point of fastening, and has the tendency not only to pull away the breech part from the barrels, but also to turn it away. The object of the breech-closing action according to this invention, which is not subject to modifications in dimensions due to alterations in gauge, is to avoid the above drawbacks."

The device is illustrated in the drawings reproduced. The locking device consists of the interrupted screw *a* which is adapted to turn

Fig. 1

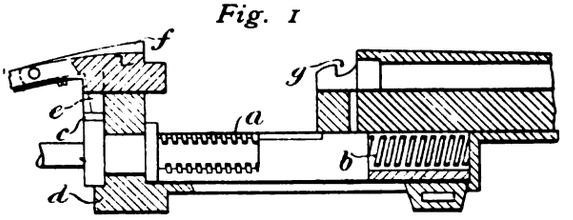
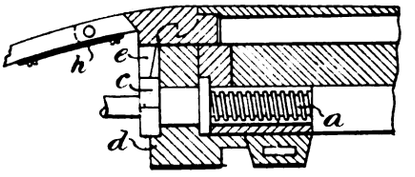
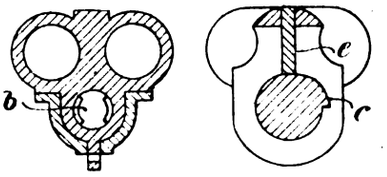


Fig. 2





in the socket *b* and to engage the interrupted screw thread cut on the interior thereof. The socket is brazed to the underside of the barrels. The enlarged head *c* of the screw *a* rests in the back wall *d* of the breech body. When the screw *a* is turned out of engagement with the screw thread by any suitable means, the cam-shaped part on the head *c* lifts the arm *e* projecting down from the underside of the hook *f* to such an extent as to disengage the hook *f* from the recess *g*. The breech may then be drawn back to allow of the introduction of a fresh cartridge. When the gun is loaded and the screw *a* is turned into position, the pin *c* descends and the hook *f* is pulled down into the recess *g* by the spring *h*. The barrels and breech are thus firmly coupled. Accepted March 30, 1905.

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CONTENTS.

CURRENT TOPICS.

Pigeon Shooting at Hurlingham.—In a few months' time pigeon shooting at Hurlingham will be as inappropriate a heading for an article as snakes in Ireland. Our leading sporting paper in commenting on the decision to abolish pigeon shooting at Hurlingham, struck the right note when it pointed out that the abolition of this section of the Hurlingham Club's programme of amusments was doubtless in response to the development of a healthier tone in the world of sport. Bear-baiting and cock-fighting long ago lost their sway, and pigeon shooting and rabbit coursing seem likely to share the same fate. Those who have passed the portals of the ordinary pigeon club must have experienced a certain sensation of condoning by their presence, a brutal and unmanly class of sport. This, at any rate, is the impression which has more than once been felt by friends who have accompanied us on the rare occasions of our visits to such resorts. Pigeon shooting is usually associated with some of the more discreditable forms of gambling. Young men of newly acquired wealth are misled by their earlier successes into supposing that they can hold their own against practised exponents of the sport. In due course they find out their mistake, generally after it has cost them a sum of money which in the nature of things is never publicly known. So long as the sporting papers gave prominence to the guns and powders used in these contests, the trade had a certain advertising value for those who obtained this free mention of their wares. It was not of course by any means a free advertisement because the expenses incidental to retaining the pigeon shooter's patronage were considerable. The cessation some years ago of press references to winning guns and powders has removed the inducement that previously existed for gunmakers to pay special attention to a department of their business which was not of any great importance from the point of view of turnover. This sport having now attained the peculiar position by which a large proportion of its patrons shoot under assumed names we may fairly regard it as amongst the dying industries. This at any rate is our own view of pigeon shooting, and we feel that its gradual disappearance will not strike a blow at the legitimate pursuit of game living in a state of nature.

The Late Mr. R. H. Housman.—Every reference, both public and private, which has been made to the death of Mr. R. H. Housman, has been accompanied by the sincerest expressions of sympathy and regret for the loss of one who could so ill be spared. He passed away quite suddenly on the 2nd ult. while at the home of his sister in Bath. The particular reason why Mr. Housman's loss is so keenly felt is that such men as himself are not made in a day or a year. In fact each generation produces but one or two of his sort at the outside. The gun trade of Great Britain and its dependences has never required more technical assistance of a reliable kind than at the present juncture. Rifle succeeds rifle and cartridge succeeds cartridge with such rapid evolution that none but the highly educated scientist can keep pace with the problems that are presented. The success of our manufactures depends in a great measure upon the limited few who have the brains and the boldness to initiate fresh developments at the psychological moment when the world of sport is ready to receive them. Mere professorial familiarity with scientific rules and algebraical signs is of no use unless it is accompanied by the special form of ability which grasps the practical issues involved. Mr. Housman was essentially one of the very limited

class which combines the power of original thought with a full knowledge of practical and scientific consequences. There may be others in plenty who are every bit as clever scientifically and have all the Mason's College qualifications which Mr. Housman possessed when he first took up the study of firearms. But the loss we have incurred is the disappearance of ten years of accumulated experience in firearms, and the peculiar faculty of applying this experience to a scientific end. His studies were already rendering a rich harvest of improvements and new developments. Our sincere sympathy is divided between the industry which has lost an enterprising brain, and the firm who have lost an exceptionally able and loyal servant.

Our Lecture on Rifle Sights.—The kind of lecture which we find gives as much pleasure to the writer as we hope to the reader is one that expresses in simple language the arithmetic incidental to target shooting. Although we are frequently forced to adopt what Capt. J. H. Hardcastle describes as the symbolical argument of a series of quotations, we feel much more at home when the most we ask of our readers is a knowledge of simple arithmetic combined with the use of decimals. We feel sure that much of what appears in the current lecture is in the nature of novel information to a large number of our readers who nevertheless have good general practical experience in the shooting of rifles. It is not that they are without the practical knowledge that covers the same ground, but rather they may not have reduced to actual figures the obvious relations they know to exist. The recent extension of club rifle shooting necessitates on the part of the young gunmaker a close study of the particular kind of marksmanship problem which has previously been confined to the gunmaker who laid himself out for the volunteer business. A man must be an enthusiast with the rifle to understand the host of intricate little problems entailed in its successful use. In our lecture we have endeavoured to show how simple is the underlying basis of theory which governs a great deal of what happens. We should not be so insistent upon the need for this particular kind of information if there were not so many evidences of the violation of common-sense principles in the sighting of weapons which are submitted to the public. The machine made rifle is generally the product of a factory which expects that Lyman sights will be used if good work is required. There are accordingly many little details of adjustment which the gunmaker can effect in order to make the goods more saleable, but to work in the right direction it is necessary that the essentials of marksmanship should be clearly understood. Our lecture is an attempt to show the relation that exists between errors in the position of the group of shots, and the corresponding needful correction of the sights.

The Wind Problem.—The very interesting letter which we publish from a correspondent raises a clear issue as between the two schools of thought concerning the action of the wind on rifle bullets. The currently accepted theory demands a whole-hearted belief in certain views which appear to many to be hostile to common-sense principles. It may be that the point of view from which the problem is regarded by those who allege a fallacy in the reasoning put forward is a wrong one. What we want is a clear statement of the correct point of view which will relate the artillerist's theory of wind deflection with accepted fact in other directions. That a certain mathematical process will produce the required result does not imply that the underlying theory is the correct one. It is, therefore, on a question of principle that our present correspondent differs from the formula which was put forward in our last lecture to young gunmakers. Light is much indeed, and we trust that a clear course may be defined. One of the greatest difficulties in arriving at a proper solution of problems of this kind is that there appears to be no obvious crucial experiment which can be made to determine the points at issue. Accurately recorded results taken from a large number of shooting experiences at the range would no doubt go a long way towards providing the data upon which a sufficient number of calculations could be made to test the relative merits of the two different ways of regarding the influence of the wind. The various Bisley marksmen who have committed their thoughts to writing have put forward a variety of more or less empirical formulæ which are mostly incapable of mathematical demonstration. Other theories which can be demonstrated mathematically seem to involve doubtful assumptions. What we want is correct mathematics based upon sound theory.

Competition in the Explosives Trade.—The balance sheets of the various companies interested in the manufacture of explosives mostly show a diminished rate of earning which is generally attributed to keenness of competition. If we throw our minds back over a period of ten or a dozen years we shall find that there has been in the interval an enormous increase in the number of firms making high explosives. At the time we are thinking of the Nobel factory at Ardeer and the National and the British and Colonial factories in Cornwall were about the only three concerns making nitro-glycerine explosives. The Stowmarket company made gun-cotton, but beyond the firms making black powder, nitrate of ammonia explosives and smokeless powder very little more was done. With the giving out of the first cordite order Messrs. Kynoch entered the field as manufacturers of nitro-glycerine and gun-cotton for cordite. They put up a large factory and naturally devoted a share of their attention to blasting gelatine and other mining explosives of an allied nature. The National Company received a half-share of the order that was given out at this time, and they again largely extended their works and spent a good deal of money in making an active bid for general business. Shortly after this the Chilworth Company commenced the manufacture of cordite and thereby added another name to the list. In due course of time the Stowmarket factory was fully equipped for the manufacture of cordite and other nitro-glycerine explosives. Messrs. Curtis's and Harvey erected a similar plant directed towards the same class of operation. Meanwhile, Messrs. Kynoch had erected their Thames factory, in addition to the original installation at Arklow. While this was going on in our own country the South African Explosives Company had erected an immense works to cater for the local supply, and the De Beers Company carried out the same kind of scheme near their Kimberley mines. We accordingly find that the adoption twelve or so years ago of a service explosive containing nitro-glycerine has incidentally produced conditions which have a serious influence on the price of blasting explosives. Things will no doubt settle down in due course but the problem of maintaining profits is a difficult one.

THE LATE MR. C. W. CURTIS.

AT the advanced age of 81 years Mr. Charles W. Curtis died at his residence Kearsney Abbey, Dover, on the 5th ult. As president of Messrs. Curtis's & Harvey, Ld., he was by age and associations the *doyen* of the gunpowder industry. He came of an old city family. His grandfather, Sir William Curtis, was Lord Mayor of London in 1795, and having for 35 years represented the city as its member in Parliament he was created a baronet in 1802. Mr. Curtis was accordingly not the senior member of the family, that position being held by Sir William M. Curtis, who was present at the funeral amongst the mourners. Mr. Curtis's father, Charles Berwick Curtis, was the youngest son of Sir William Curtis. Although descended from a younger son the late Mr. C. W. Curtis may rank as the head of a large collateral branch of a distinguished family. In politics he was a staunch conservative, and although it is now many years since he engaged in active business the many tributes of sympathy and affection which came from the Company's factories showed that his memory was dear to the staff and employees generally. As one whose assistance was freely given to all charitable and local enterprises he had many friends not only in the neighbourhood of his residence but in other centres besides. Although it may seem a little cold to judge a man's good works by the wreaths and crosses which are sent to his funeral we feel none the less entitled to refer to the extraordinary number of these evidences of kindly feeling, a list of which was given in the local newspaper. In fact we cannot but recognise that, although we never had the pleasure of a personal acquaintance with Mr. Curtis, his record shows him as the typical English gentleman of kindly disposition with views broadened by close acquaintance with business administration.

Educated at Harrow, and in later life devoting himself to many important branches of public work, he was able to fill the social part of his life with active endeavour and interesting experiences. As Justice of the Peace for Kent, the Cinque Ports and Wiltshire, where he took an active part in the Council, his broad sympathies were well employed; while as the owner of a picturesque country seat he was able to cultivate a strong leaning towards art, literature and nature. He leaves five sons and five daughters. The traditions of the house are continued through his sons, Colonel C. H. Curtis and Mr. Thos. R. Curtis, the former acting as chairman and the latter as vice-chairman of Curtis's & Harvey, Ld. We cannot do more than add our own tribute of respect for the memory of one who, while a plain business man, had many of the traditional characteristics of the *grand seigneur*.

His aptitude for business can best be expressed by the world-wide reputation of the firm of which he was the senior partner. Wherever gunpowder was used, whether in guns, rifles, artillery, quarries or mines, the firm's specialities commanded a leading position in the regard of the user. Though the advent of the newer explosives at first found the firm unready to cope with a changed order of things the loss was rapidly made good under the direction of a capable management and well organised system of distribution. The name of Curtis's & Harvey stands in the foremost rank of our explosives companies, and this result is largely attributable to the fact that the present members of the family show no desire to rest content with the laurels of a former generation's earning.

A court of inquiry was held at Tiverton on the 18th ult. relative to the circumstances under which Private R. Strawson, of "E" (Tiverton) Co., 3rd D.R., met with an accident on the Chevithorne range on the 11th ult. The proceedings were strictly private, but it is understood that no material light was thrown on the cause of the accident. Sergt. Knight, who was taking the register of the scores at the time, heard a report, and saw Strawson put his hand up to his face, which was bleeding profusely. He could not say how the accident occurred. Corpl. Payne saw Strawson pull the trigger, and then put his hand up to his face. Strawson had cycled out to the range with his Lee-Metford rifle, and was the first of a batch to shoot at the 200 yards range. He inserted a cartridge in the usual way, took aim, and pulled the trigger. As he did so there was an explosion, and he felt something strike his eye. He was an experienced shot, and was unaware of having done anything likely to cause an accident. The rifle on examination showed that the bullet was lodged about half-way down the barrel.

AT the Spring General Meeting of the National Rifle Association, the chairman announced that negotiations were proceeding between their council and the committee of the Society of Miniature Rifle Clubs with a view to seeing whether a scheme could be devised for the N.R.A. to take over the work of the Society. Overtures in this direction were first made by Lord Roberts, and it is understood that the need for some such step arose from the inability of the Society of Miniature Rifle Clubs to secure the funds necessary for adequately carrying out its important mission.

AN ARTILLERY HANDBOOK.

APART from the service handbooks, which at times err on the side of undue condensation, there are very few books since the day of Longridge which seek to elucidate the points of difficulty encountered by the student. America is well served in this respect by such writers as Ingalls and Bruff. Over here we have plenty of knowledge of the right kind, but its proper expression in the form of explanatory technical treatises suffers from the throttle valve action of the Official Secrets Act. In a new half-guinea book by Major H. A. Bethell, of the Royal Field Artillery, entitled *Modern Guns and Gunnery*, we have a really praiseworthy attempt to supply a good general description of modern horse, field and mounted artillery material, collected in a form not hitherto obtained by the general public. The book opens with a table of contents, in which the subject matter of each chapter is set out in a manner that gives the reader an excellent bird's-eye view of the ground covered. This table only lacks the page numbers for each chapter and chapter section to make it perfect.

The following summary of some of the chapters, while open to the charge of being too straightforward, may prove of use to the reader:—Chapter I. Internal Ballistics: Good general. II. Theory of Construction of Guns: Good general. III. Sights: Good general. IV. Rifling: Colloquial. V. Theory of Construction of Cartridges: Good general. VI. The Gun-Recoil Carriage: Good general VII. The Shield: Good general. VIII. Ammunition: Good general. IX. The Q.-F. Field Howitzer: General. Part II. Theoretical gunnery. Chapter XI: The unimpeded (query unresisted) Motion of a Projectile: Descriptive and explanatory. XII. The Motion of a Projectile in Air. This chapter refers to a table which we have not been able to find. The author refers to the coincidence between the kinks in a curve of resistance, for projectiles of different velocity which occur respectively at the velocity of sound and the velocity with which air rushes into a vacuum. He says no scientific explanation of these phenomena is yet forthcoming, whereas in our opinion the coincidence is itself the explanation. Other portions of this chapter handle a difficult subject briefly and with great clearness, but we should like to qualify this in one respect, viz., by asking what experimental proof can be adduced in favour of the statement, that the ideal shape of a shell, intended to travel through the air with a minimum resistance, is that of a Whitehead torpedo with a long tapering tail. XIII. Ballistic Tables and their Use: We have here a brief summary of the material contained in various other works on the same subject. The reference to Table VII. of the *Text Book of Gunnery* suggests that the author is not quite familiar with this aspect of gunnery. XIV. Accuracy of Fire: This is very general. We notice by the way that Chauvenet's table of probability factors is quoted from the second-hand source of Mackinlay's Text Book of Gunnery. XV. Deflection of Projectiles by Wind: This mentions Younghusband's method, which is dismissed after a brief mention. Capt. Hardcastle's graphical wind chart is, however put forward as giving a good working approximation for a given force and direction of wind. It receives special commendation because it takes account of the increase of wind effect over the portion of the trajectory where the shot reaches to a considerable height. XVI. Recoil; This is too general to be of much use. In fact, this chapter appears to be out of touch with the much more complete statement of the subject as applied to small-arms by the recent *Field* reports of experiments with special recoil-testing apparatus. The author does not, in our opinion, sufficiently clearly distinguish between the recoil due to the movement of the shot and that due to the powder. The mathematical relations are quite simple, and at the same time more clearly related to practical work than is the mode of demonstration adopted by the author. This chapter might with advantage be re-written, should a future edition be required. XVII. Shrapnel Fire: Too general to be of much use. XVIII. Weight and effect of Shrapnel Bullets: Superficial. XIX. Shrapnel Fire (continued): This chapter is again a bit too much in the style of a newspaper article to be of serious technical value.

The next portion of the book, Part III, is devoted to the soldiering aspects of gunnery, and need not accordingly occupy our attention. Part IV.—This contains some very useful information concerning modern quick-firing equipments of various types and nationality. Part V., on gunnery calculations, contains a good chapter on the use of the plotting chart. The chapters on Trigonometrical Tables, Mensuration, Four-figure Logarithms and the Slide Rule are somewhat juvenile. The book concludes with some tables and an appendix entitled "The Evolution of a Field Gun," which is reprinted from the proceedings of the Royal Artillery Institution. While this book contains an immense amount of useful material, it is not, of course, scientifically exhaustive. It is undoubtedly written by a good practical man; but his work would have gained considerably from the services of a competent editor. It is illustrated in a manner superior to books of a similar kind, and altogether we think that while the author is not entitled by the fact of having written it to rank as one of our foremost scientists, he, at least, knows how to convey the ideas collected during a long practical experience.

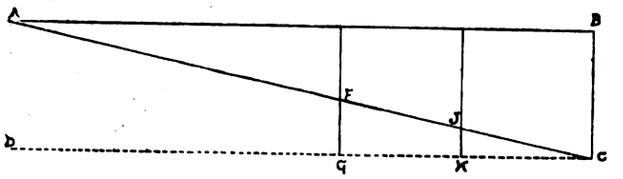
THE fact that *Land and Water* has been "amalgamated" with the *County Gentleman* brings to an end the separate existence of a paper which has always occupied a prominent position in the world of sport and yet which has never been considered as having obtained a firm financial hold. The obvious money-making capacity of *The Field* has often lured newspaper speculators to endeavour to set up in rivalry with it. But each attempt has hitherto shown that there is only one *Field*, and that the journal bearing this name has a peculiar standing which confers something very nearly approaching a monopoly in its own particular line of country. This attribute is not the outcome of any single item of policy. That it is a newspaper and not a magazine is admittedly one of its strong points. Another is that it has never attempted to do things on the cheap. In addition to these and many similar business reasons for success it is a paper which is governed and always has been governed by traditions which rise above personal considerations. The policy that was framed by the late Sergeant Cox, and put into practice by the late Dr. Walsh has stood the test of time, and so long as each succeeding generation of sportsmen grows up to appreciate the ideals kept in view by *The Field* its position will always be a strong one. Meanwhile, the magazine style of dealing with sport opens up new and not yet fully cultivated ground. There is a public which is always ready to absorb the bulk of its information through the medium of pictures. The wide extension of photography, and the concurrent development of half-tone printing have duly influenced the newspaper world. The trouble is that a *good* article well illustrated is a costly production, and to produce several of these each week is an anxious task.

WIND DEFLECTION.

TO THE EDITOR OF *Arms and Explosives.*

SIR,—Those of your readers who, like myself, follow your very interesting "Lectures to Young Gunmakers," must have felt indebted to you for your recent explanation of the action of wind on rifle bullets. Although I have spent time on the subject I confess I am not yet clear in my own mind. This may be because my introduction to wind deflection was prior to the publication of the method you described. This letter is written with the hope that others who have at one time regarded this subject from the same point of view as Colonel Maitland when he gave us his formula, and have since seen the greater reason of the method ascribed to Capt. Younghusband, will point out the way to those who, like myself, still have difficulties.

Let me first state my conception of the Younghusband method. Let a bullet leave a rifle in the direction A B, this line being a prolongation of the axis of the barrel; also let



A B represent the space the bullet would pass over in one second if unresisted, *i.e.*, in vacuo. Again, let there be a cross-wind and to the same scale let B C be the movement of the wind in one second, also let C D be parallel to A B. Now, at first, assume the air has no retarding effect on the bullet. Let our datum line A B move with the wind parallel to itself and let us consider the bullet's movement from this line carried with the wind. Obviously A C will be the path described by the bullet, and in one second the bullet will be at C and the muzzle of the gun at D. Note the centre of gravity of the bullet takes the direction in quiescent air orginally impressed upon it but the axis of the bullet turns from A B to A C taking the direction of the resultant air movement for reasons well understood by study of the gyroscope. We may now regard the compound air movement around the bullet as replaced by a resultant one in the direction C A Younghusband assumes the wind effects are obtained by consideration of this resultant air movement with respect to the bullet. To revert now to the actual conditions, we know the air resists the bullet's movement, and in one second instead of arriving at C we will assume our bullet possesses such characteristics that it reaches a point say F. Then Younghusband's method gives G F as the deflection due to the assumed wind.

Now suppose our particular bullet is increased in length so that the sectional density is doubled, in a second the bullet would arrive at a point intermediate between F and C, viz., J., and the deflection due to the wind, J K would be about halved as the formula shows. This is where my difficulty arises. In doubling the sectional density the side area of the bullet on which the wind presses is increased nearly as much as the mass, and the time the wind acts is the same, yet the amount the bullet is deflected is only about one half. To my mind this does not appear reasonable. With a spherical bullet this objection would not exist, but with elongated projectiles it seems to me an error is made in taking the resultant air movement with respect to the bullet as the resultant force acting on the bullet, because the area on which the two air movements act is different. Furthermore, the resistance offered by the air is not directly proportional to the velocity of the air movement.

To make above even more obvious we may imagine that our long bullet is made of material such that its weight is the same as the shorter one and therefore the sectional density of each the same. Younghusband states both these bullets would be deflected by a given wind to the same extent although one offers an area to the wind practically twice as great as the other. We might develop this still further by assuming that the projectile is increased to a greater and greater length. Nevertheless, the sectional density remaining constant, by Younghusband the wind should have the same effect on all. This is a result which to say the least is paradoxical.

My idea is that a better method for dealing with wind deflection is to regard the velocity at right angles to the bullet as its velocity up wind with a ballistic co-efficient represented by a side view. Then determine the necessary details for deflection from S, and T tables extended to the low velocities of wind.

ENQUIRER.

THE CHEMISTRY OF RUST.

OUR recent article on the preservation of rifle barrels has given rise in some quarters to misapprehension. We therefore add the following in further explanation of our views. There exists a common belief that rusting in rifle barrels is due entirely to acids in the products of combustion of a gunpowder. If acids exist in the gases left in a barrel after firing, corrosion is certain to follow, but rusting will also result, if precautions are not taken, when acids are absent, and for these reasons: Water and carbonic acid gas (carbon dioxide are present in comparatively large proportions in the products of combustion of all gunpowders. Also, the act of firing removes all grease from the metal inside a barrel, and leaves it more or less exposed to the action of the gases in the barrel Under these conditions corrosion is certain to follow after a time, if the barrel is not thoroughly greased or otherwise protected at once. Prof. Vivian B. Lewes, in *Service Chemistry*, states: "When iron is exposed to pure dry air, no rusting of the surface takes place, but in moist air containing carbon dioxide, corrosion rapidly commences." Further, he says that moist air free from carbon dioxide, and also dry carbonic acid gas has little or no action; the corrosive action results when moisture exists in air containing carbon dioxide. In a rifle barrel this state of affairs always exists, and we imagine that "Fluor Oil" is so beneficial because, unlike oily substances, it wets the whole surface of the barrel, and the alkaline nature of the fluid neutralizes not only any acids which may result from combustion, but also the carbon dioxide always present in the gases of the barrel. This explanation seems to us to carry the science of rust in barrels to a point that appears a complete justification for the original idea involved in the composition of the above mentioned preparation

RIFLES FOR BISLEY.

THE programme for this year's Bisley contains the usual mass of information which the competitor finds it so difficult to grasp in its entirety. We present, however, an extract from the definitions of the various special rifles to be used, together with particulars of the ammunition to be used with the same :—

MATCH RIFLES.—Any breech-loading rifle complying with the following conditions. *Proof Marks*, when of British make, to bear proof marks both on barrel and breech. *Weight of Barrel*, not including any removable appliances, not to exceed 3¼ lbs. *Calibre*, maximum, ·325. *Pull of Trigger*, minimum, 4 lbs. *Sights* of any description. *Ammunition for same*, any ammunition complying with the following conditions : The cartridge generally must be a serviceable one from a military point of view, and having regard to the weight to be carried by the soldier.

MILITARY BREECH-LOADING RIFLES.—The regulation military rifle of any country, or any breech-loading rifle complying with the following conditions : *Weight of Rifle*, not exceeding 8¾ lbs., exclusive of bayonet, but including attachment for bayonet and for sling. *Calibre*, maximum, ·315. *Stock* must be suitable and sufficiently strong for service purposes. It must be fitted with swivels for a sling, and must not be checkered. No pad or shoe for the heel of the butt is allowed. The butt plate must not be checkered. *Pull of Trigger*, minimum, 4 lbs. *Sights* may be of any description, except telescopic or magnifying, but must be affixed to the barrel. Spirit levels are allowed. Both foresight and backsight and also the spirit level (when one is used) must, in the opinion of the Bisley Committee, be strong enough for military purposes, and must be capable of being used in the prone position. *Ammunition for same*, any ammunition complying with the following conditions : *Weight of Cartridge*, maximum, 460 grains. *Weight of Bullet*, maximum, 250 grains. *Observed Velocity*, minimum, 1950 feet per second. The cartridge must be suitable in the opinion of the Bisley Committee for military purposes. When foreign regulation rifles are used the service cartridge proper for that description of rifle may be used.

SPORTING RIFLES.—Any single, double or repeating rifle (whether of Government pattern or not) complying with the following conditions : *Calibre*, any. *Pull of Trigger*, minimum, 3 lbs. *Sights*, open sights, or such as have received the sanction of the Council or of the Bisley Committee. The Lyman backsight of the usual pattern and the Beach combination foresight have been sanctioned. No lateral adjustment of fore or backsight will be permitted. The centres of both sights must be fixed over the centre of the barrel. If a platinum or other line is used on the backsight, only one such line is permitted. Spirit levels are allowed. *Ammunition for same*, any ammunition.

MINIATURE RIFLES, CLASS A.—Any rifle, the new and retail cost of which, including the sights used with it, does not exceed £3 10s., complying with the following conditions : *Weight*, maximum, 8 lbs., complete as used when firing. *Calibre*, maximum, ·325. *Pull of Trigger*, minimum, 4 lbs. *Sights*, open, or such as have received the sanction of the Council or of the Bisley Committee. The Lyman backsight of the ordinary sporting pattern, and that with a detachable orthoptic disc not exceeding ⅜ in. in diameter, has been sanctioned. No lateral adjustment of fore or backsight is permitted. CLASS B.—Any rifle of a pattern now issued for service to H.M. forces, but modified so as to use any cartridge complying with the conditions set out below, and costing not more than 4s. per hundred (retail list price), and complying with the following conditions : *Barrel*, must be externally of the same dimensions as the service barrel of the same pattern of rifle. *Sights*, the same as for the same pattern of rifle as issued for service. *Pull of Trigger*, that allowed by these regulations for the same pattern of rifle when used with the service cartridge. *Modifications*, the only modifications allowed are—(1) the barrel may be bored, rifled and chambered to admit of the use of the cartridge ; (2) the bolt may be modified so as to fire and extract the cartridge ; (3) the magazine may be modified or omitted. *Ammunition for same*, any ammunition complying with the following conditions : *Calibre*, maximum, ·325. *Observed Velocity*, maximum, 1450 feet per second. *Weight of Bullet*, maximum, 140 grains. *Cost*, maximum per 100 (retail list price), Class A., 5s. ; Class B., 4s.

RIFLES WITH REDUCED CHARGE.—Any service rifle firing a reduced charge or small cartridge through a tube or otherwise, or the Martini-Henry rifle fitted with the Morris or other tube complying with the following conditions : *Pull of Trigger*, minimum, 6 lbs. *Sights*, as defined for service rifles with such modifications only as, in the opinion of the Bisley Committee, are necessary to enable a miniature cartridge to be used. *Ammunition for same*, as defined for miniature rifles with the addition that the maximum cost of reloaded cases is to be 4s. per 100 (retail list price).

Criticising the above particulars in the order in which they appear, it is interesting to note in reference to the match rifle that two important changes have been made ; first, the reduction of the minimum trigger-pull from six to four pounds ; and second, as regards the sights, the removal of the exclusion of those of the telescopic and magnifying order. The definition of the sporting rifle does not, it will be observed, lay down any requirements which necessitate the use of a rifle of true sporting pattern. However, as the sporting competitions at Bisley bring out some very interesting characteristics of various weapons of non-military type, we must welcome the latitude that leaves every freedom of choice. In the matter of miniature rifles, we have last year's definition under the heading of Class A. The definition of the rifle and ammunition is one that literally carried out would produce a cartridge that seems hardly to fit in with the description of miniature. A bullet of 140 grains with a maximum observed velocity of 1,450 feet per second is only miniature by comparison with a full-power service cartridge. We ought, in fact, to sub-divide miniature rifles into indoor and outdoor, because what is miniature for one set of conditions, is excessive under others. The Class B miniature rifle is a strange product of the rule-drafter's fancy. The idea of a service rifle chambered and bored to take a ·22-bore cartridge is undoubtedly excellent, but to suppose that a manufacturer is going to make such a rifle to take a 140 grain bullet, giving a velocity of 1,450 feet is to accuse him of not knowing his business. That is to say, the ordinary service rifle with a reduced charge can be made to do such splendid shooting that there is no need to bore the rifle for a special cartridge. The only possible function of a specially bored service pattern of rifle is to adapt it for using miniature indoor ammunition of the ·22 rim-fire type, thereby obviating the disadvantages incidental to the use of the Morris tube, and worse than this, Morris tube ammunition.

ROUND THE TRADE.

The firm of Eley Bros., Ld., have accepted the sole agency for the rifle cleaning preparation, Fluor Oil, which was mentioned in our last issue.

We understand that Messrs. Cogswell & Harrison, Ld., have acquired and are fitting up a shooting ground near Colnbrook station on the Great Western Railway.

Messrs. Debenham Storr & Sons, have issued a notice to the effect that their next sale of guns, rifles, and other sporting accessories will take place on Wednesday the 14th inst.

The west of England local papers in their notices of the Devon agricultural show make mention of the well-known Kynoch cartridge exhibit which was for so many years a feature of the Bisley camp.

Henry Atkin, Ld., was registered on the 15th ult. with a capital of £3,000 for the purpose of taking over the gunmaking business of Mr. Henry Atkin previously carried on at No. 2 Jermyn Street, and recently transferred to No. 41.

Colonel F. W. J. Barker, R.A., who has been superintendent of the Royal Small Arms Factory at Birmingham since October 1892, has been granted a further extension of employment until March 31 next, when he will finally retire.

Mr. W. M. Thomas left England about the middle of last month, terminating an interesting and instructive visit to this side of the Atlantic. He did not spend the whole of his time in England, having paid a number of duty calls on the Continent.

The Kynoch Company have issued a card notice containing a digest of the circumstances of the Kynoch *v.* Pollard case reported in our last issue, the same being no doubt intended to be hung up as a warning that minimum prices must be duly respected.

It is reported that the new secretary of the Gunmakers' Association is Mr. R. H. Angier who has made quite a name for himself as a student and critic of military rifles. This appointment curiously reflects the close connection which seems to exist between the official work of the gun trade and writers for the newspaper press.

Mr. Arnold Forster stated in Parliament that the estimated cost of the new wind-gauge backsight as fixed to the new rifle is 7s. 6d. This is propably the contractor's price to the Government. Consequently the private purchaser might have to pay double or treble this amount to cover royalty for the valuable invention contained therein.

At the Annual General Meeting of the Morris Tube Company the chairman referred to the appointment of Capt. E. W. Davies, late of the Royal Arsenal at Woolwich, as superintendent of the whole of the staff at the works. The services of Mr. Stentiford, the late works manager, have been retained by putting him in charge of manufacturing operations.

It gave us great pleasure a few days ago to receive a visit from Mr. A. B. Hollis of Bombay. He reports a satisfactory season's work in India with an active demand for the many shooting specialities in which he trades. In speaking of proprietary rifles from abroad he mentioned that Winchester high-power magazine weapons are excellently regarded by Indian sportsmen.

The death is announced of Mr. James McNaughton, senior partner in the firm of James MacNaughton & Sons, gunmakers of 26 Havover Street, Edinburgh. He was 66 years of age and held a very high position as a maker of high-class shot guns and rifles. He it was who gave a prize at Bisley to show that his double barrel rifle could make good shooting at 500 yards, using the two barrels alternately.

Among the list of stores destroyed in South Africa the official returns include 7,210,792 rounds of small arms ammunition. This is part of a total of 50,000,000 rounds sent back from South Africa with a view to inspection and sorting out the unserviceable. The date of supply could not be traced; but as every manufacturer of importance is included in the list of contractors supplying them, in addition to the ordnance factories themselves, no one is disgraced.

The report for last year of the King's Norton Metal Co., Ld., is delivered with a brevity of language which means well for the shareholders. A total profit of £48,277 provides for a seven per cent. dividend on the preference shares, ten per cent. on the ordinary shares, and in addition a bonus of £1 per share, on the ordinary shares which is equivalent to a further ten per cent. £7,000 has been appropriated to depreciation, and £5,000 to reserve account, leaving £4,560 to be carried forward.

Capt. J. H. Thomson's report on the explosion at the factory of the Pegamoid Company, which occupies a site on the licensed area of Messrs. Eley Bros., property at Angel Road, shows that the accident probably resulted from frictional ignition of collodion cotton dust. H.M. Chief Inspector shows that no blame can be attached either to the manager of the factory or to the man who lost his life by the accident. In fact the mishap appears to have arisen entirely from the great sensitiveness which is inseparably associated with nitro-cotton when in a condition of extreme dryness.

The American papers illustrate a most refined means of evading the obvious rules of standing shooting. The idea of this position is of course that the shooter shall hold his rifle or revolver as steadily as possible, thereby learning to control the natural quiver of his muscles. The American device consists of a kind of truss which is fixed under the clothes and attached to a belt in the manner that one associates with the mechanism of an artificial limb. A metal framework passes from the waist to the elbow and provides a most perfect artificial rest of a kind that can never be allowed in properly conducted standing shooting.

A somewhat strange prosecution under the Pistols Act was recently instituted in Manchester when the vendor was fined 40s. and costs and the purchaser, a boy of 16 years of age, 2s. 6d. and costs, the former for selling and the latter for buying a toy pistol of the kind which projects small shot pellets a few yards. This weapon was a pistol within the meaning of the Act, and although it seems like going to extremes we cannot as members of the public regard with disfavour an enactment which provides a prompt and effective check on the misuse of a small but none the less dangerous weapon. The boy fired the pistol in the street, and thereby brought himself within the compass of the Gun Licence Act.

The report of the National Explosives Co., Ld., shows a trading loss of £16,631 after payment of £6,079 for debenture interest. This loss has been incurred mainly as the result of two explosions which occurred respectively on January 5th at the Company's works and on May 19th at a magazine in Western Australia. The deficit has been met by a transference of £20,000 from the reserve account. This has further provided the means for writing off the whole of the sum standing at the debit of debenture issue expense account, viz. £5,031. A balance of £1,330 is thus carried forward. The report makes mention of the continued loss of profit due to the still increasing keenness of competition for the trade in blasting explosives.

At the twenty-second ordinary general meeting of the E.C. Powder Company there was a justifiable exhibition of mutual congratulation concerning the past year's very satisfactory trading. In spite of competition and a none too satisfactory game season the Company has been very successful in showing total sales exceeding any previous year's record, and a net profit substantially in advance of the previous year, notwithstanding the enhanced price of ingredients. The net profit of £8,794 provides for a ten per cent. dividend upon the shares, an addition of £2,000 to the fire insurance fund, and a writing off of £1,000 from the patents account, thus leaving a nominal amount to add to the £3,529 of carry forward. The chairman pointed out that when he and his colleagues joined the board the item for patents stood at £38,000. This has now been reduced to £3,000, while in addition no less than £15,000 has been invested in sound securities outside the business. Considering that the above item now includes goodwill and secret processes it is clear that it does not overstate the value of E.C. powder as a manufacturing asset.

A FÊTE DAY AT STOWMARKET.

THE directors of the New Explosives Company have reason to feel very proud of the perfect success which attended the inspectional visit paid on the 25th ult. to their works by a large party of distinguished guests. A special train had been chartered from the Great Eastern Railway, and it left Liverpool Street at 9.55 in the morning, bringing the party back at 4.55 in the afternoon, after a most interesting and instructive day. The visitors who took advantage of the Company's kind invitation may be roughly classed under four headings; first and foremost there were the chiefs of various Government manufacturing and inspectional departments; second, representatives of foreign countries and embassies; third, general visitors; and finally there were members of the fourth estate whose function it was to chronicle the events of the day. The last-named while no doubt highly distinguished in their profession would politely refrain from taking the adjective we have used as referring in any way to themselves.

Among Government officials there were Major-General D. O'Callaghan, C.V.O., R.A., President of the Ordnance Committee; Colonel F. E. Mulcahy, C.B., Director of Ordnance and Equipment Stores; Lieut.-Col. R. H. Mahon, R.A., Ordnance Committee; Lieut.-Col. L. T. Pease, R.M.A., Ordnance Committee; Capt. M. Singer, R.N., Ordnance Committee; H. R. A. Mallock, Esq., F.R.S., Ordnance Committee; Major Sir H. W. W. Barlow, Bart., Superintendent Royal Laboratory; Major R. Handley, R.A., Assistant Director of Artillery; Major F. L. Nathan, Superintendent Royal Gunpowder Factory, Waltham Abbey; L. Brennan, Esq., C.B., The Brennan Torpedo Factory; Capt. C. F. Randall, R.E., Superintendent of the Brennan Torpedo Factory; Sir William H. White, K.C.B., F.R.S.; Admiral Harris, K.C.B., K.C.M.G., President Royal Naval College, Greenwich.

The foreign representatives included *United States of America:* Major John H. Beacon, Military Attaché; Capt. Stockton, Naval Attaché; *Bulgaria:* M. D. Tzokow, Diplomatic Agent; *China:* Yin Shou Ling, Attaché; T. C. Luipao, Attaché; Chi Shan, Attaché; Mr. L. Leslie Cox, Secretary; *France:* Capt. Mercier de Lostende, Naval Attaché; *Germany:* Capt. Coerper, Naval Attaché; Count von der Schulenburg, Military Attaché; *Japan:* Lieut.-Col. Taro Utsonimaya, Military Attaché; Capt. Makoto Kaburaki, Naval Attaché; Capt. Tanaka, I.J.N.; Capt. Fujii, I.J.N.; Capt. Asaoka, I.J.N.; *Peru:* Don Eduardo Lembeke, Chargé d'Affaires; *Russia:* Capt. Jean Bostroem, Naval Attaché; *Netherlands and Luxemburg:* Dr. Thomas, Government Analyst for the Dutch Navy. Among the more important of the non-official visitors may be mentioned Mr. T. R. Bayliss and Mr. S. J, Bayliss, of the King's Norton Metal Company; Mr. Tanagiya, Mr. Scott and Mr. H. Hirota, of Messrs. Takata & Co.; Mr. H. E. West, of Messrs. Woolston & Co.; and Major Wolley-Dod, R.A., of the Hadfield Steel Foundry Co., Ld. There were in addition several guests who are connected in one way or another with the town of Stowmarket.

The visitors were received by the chairman of the Company, Mr. F. Machell Smith, who was supported by the other directors, Mr. Henry Compton, Mr. W. W. de Buriatte, Mr. E. H. Hindley and Major-General Sir Frederick Maurice, K.C.B. The organisation of the whole proceedings had been carried through by Mr. L. G. Duff Grant, the Company's general manager with an attention to detail which reflected the highest credit on the care with which he had anticipated every possible requirement. What Mr. Grant did in respect to his side of the business, Mr. F. C. Ody, the works manager, equally well performed in respect to the arrangements for showing the visitors the extent and resources of the factory. That the occasion will always be regarded as a red letter day in Stowmarket, may be inferred from the fact that some hundreds of school children assembled in and around the station to give the visitors a parting cheer. Their impressionable minds were no doubt greatly influenced by the picturesque costumes of the Chinese contingent, and it is certain that the townspeople, old as well as young, will long remember the occasion.

The actual inspectional part of the programme was of course very similar to what generally happens at such functions. The procession from building to building, and the inspection of this, that and the other special piece of apparatus were not in themselves of spectacular importance. On the other hand nearly every visitor present was a person who by professional or business associations was able to form a true estimate of the extent and equipment of this important factory. Not only can it claim to be the birth-place of commercially made gun-cotton, but it is also thoroughly up-to-date in respect to modern improvements of method. While the extensions of recent years are in a sense an off-shoot of the original gun-cotton works, the factory as it now stands may be regarded as a perfectly equipped whole. We have first and foremost the gun-cotton section of the works, at another part the nitro-glycerin buildings, and then again the place where the two components are combined and formed into cordite. In addition to these three main sections of the factory we have the supplementary departments, which include the laboratory and offices, the acid works and the magazines. Even then we must not omit mention of the guncotton pressing department where explosive charges for shells and torpedoes are brought into shape. The Company's new plant for compressing blocks of gun-cotton, instead of building up the charge from a series of segments, was the subject of special examination by the visitors. This highly important invention may be regarded as the most up-to-date method of building up large charges of gun-cotton, and the Company deserves every credit for the engineering skill it has brought to bear on the solution of a difficult problem.

However, the day was none too long for doing justice to the many items demanding attention. The visit was essentially one of experts, and the picnicking aspect of such occasions was relegated to the background. The Company admittedly displayed great hospitality by way of providing an excellent mid-day repast in a large marquee which had been specially erected. Speeches were, however, short and few. In fact beyond a proposal of thanks for the kind entertainment by Major-General O'Callaghan and a brief reply from the chairman very little was said. Such a factory may obviously be entrusted with the most important contracts, and their technical qualifications for the task are evidently such as to ensure, not only a satisfactory rate of delivery, but more important still a level of quality leaving nothing to be desired from the point of veiw of the most searching tests.

LECTURES TO YOUNG GUNMAKERS.

XXXV.—THE ADJUSTMENT OF RIFLE SIGHTS.

THERE are a number of practical problems in connection with the adjustment of rifle sights which are the more easily dealt with when the shooter can appreciate the arithmetical aspects of the question. In considering this matter we shall endeavour to be sufficiently general to make our meaning understood without introducing a large number of sums in simple arithmetic, the actual manipulation of the necessary figures being so simple that the main consideration is rather to explain the principles involved than to show the actual working out of examples.

If we take a rifle and fire it very carefully at a target the length of a room from the muzzle, the elevation of the sights can be adjusted until the bullet hole is below the mark aimed at by the amount that the axis of the barrel is beneath the tip of the foresight. This adjustment is known as the zero of the rifle, and if the height of the two sights above the axis of the barrel is carefully measured, it will be found that the line of sight is not necessarily parallel with the axis of the barrel. Metford showed many years ago that this is due to the jump and flip of the rifle causing the line of the muzzle to adopt a new position by reason of the disturbance due to the passage of the shot up the barrel.

These considerations may be dismissed as of merely technical interest if we elect to treat the zeroing of the rifle as the basis of the sighting problem. The shooter must nevertheless remember that the jump of the rifle is largely influenced by differences of ammunition. When a cartridge of higher velocity than the kind ordinarily used is employed, it may be found that the bullets strike lower and not higher at the shorter distances. It is also possible that they may strike sideways as well. The difference in shooting between an oily and a foul barrel may in the same way be mainly accounted for by differences of jump rather than by the amount that the small change of velocity may influence trajectory. Some rifles we have known have even shown a persistent tendency to fire high and to the right, not only with an oily barrel and also with one which, though fouled, has been set aside for some time since the last shot was fired. While, therefore, the young rifleman must never forget that jump may account for many of the eccentricities which occur when firing under conditions that exclude serious errors of aim, he may, by taking the precaution to precede every series of shots by two "warmers," confine his attention solely to the zero basis of a rifle's shooting.

It is very important to remember in this connection that if the elevation of the sights is set so that the bullet strikes the point aimed at, or above it as when aiming at the bottom edge of the bull and striking its centre, the angle used is more than is needed to correct the drop. If this difference is one inch at 25 yards it represents twice that amount at 50 yards, and in proportion for other ranges. The true angle of elevation is therefore only obtainable by considering a sight which is set to strike the above amount below the point of aim.

Having shot the rifle at a distance of two or three yards from the muzzle, thereby obtaining the zero elevation, the firing may then be repeated at any desired distance. By making a mark on the new target showing the position of the zero shooting with reference to the point of aim one can at once determine the amount of drop that occurs. It is in many instances a great advantage to be able to calculate beforehand the amount of adjustment necessary on the sights, especially when the alteration must be made with a file. Taking a concrete example, we may suppose that the bullets strike four inches below the centre of the bull at a distance of 50 yards. This is equivalent to an angle of eight minutes; but to know this isolated fact does not carry the rifleman much further; because sights are seldom marked in this manner. However, it is only by thinking in degrees that the rifleman can really understand many of the problems of marksmanship. It is well known that one minute of degree is equal to one inch for every hundred yards of range, or to be more exact 1·047 in. For practical purposes it is quite sufficient to adopt the simple inch unit as the equivalent for one minute of angle. Four inches at 50 yards being equal to eight inches at 100 yards, the relation of minutes and inches is at once apparent. To translate four inches at 50 yards into sight correction on a rifle is very simple, though not obvious to everybody. The principle involved may, however, be explained in a very few words.

First of all it is necessary to make an exact measurement of the distance between the two sights of the rifle. In the case of a long Lee-Enfield rifle, the distance from the tip of the foresight to the front V on the leaf is 21⅜ ins. From the foresight to the sliding bar the distance is 23⅛ ins. To carry out our intention not to introduce an excess of arithmetic, we will take for example a rifle of the miniature class with a distance of 18 ins. between the two sights. This is exactly half a yard, and is moreover the 100th part of our 50 yards range. Therefore, the backsight must be raised or the foresight lowered by the 100th part of four inches, viz., ·04 in., to produce the amount of correction above quoted as an example. This at once shows us that ·04 in. is the equivalent of eight minutes of angle in rifles where the sights are 18 ins. apart. The shooter can only apply this in practice by setting a micrometer or other instrument to this value and adjusting his sight by the amount so measured off. It is not, of course, sufficient to file the sight absolutely to this mark in the expectation that it is bound to give the needful correction to the shooting, since it is possible that by reason of the altered conditions a fuller or a finer sight may be taken. Nevertheless the arithmetical relation which is shown provides the basis upon which such corrections must be made.

In the case of sights which are adjustable by the turning of a screw, the conversion of angle into height of backsight is more easily performed. As an illustration of our meaning we will take the case of the ordinary Lyman sight. There is probably no shooter who has not asked when first shown this form of sight, what was the meaning of the series of degrees marked on the scale cut around the stem. By a process of simple arithmetic we will endeavour to elucidate what is probably still a mystery to 99 per cent. of the shooters who use this very handy form of sight. By way of parenthesis we may add that the astonishing nature of the scale cut by the Lyman Corporation is a mystery to all who may assume that some element of common sense must have directed the markings that are made. It is just possible that

the scale which to-day puzzles the shooter may have had its origin in the trajectory of some particular rifle to which the sight may have been fitted. But to-day, when the same pattern of sight is used for all kinds of rifles and for various lengths of barrel any justification which the scale may have originally possessed has ceased to exist.

However, to return to our demonstration, we unscrew the vertical stem from the Lyman sight, and find that the elevating screw contains twenty threads to the inch, that it is a single thread screw, and, therefore, that each turn of the knurled collar represents a 20th of an inch rise of the back-sight. If the scale were cut in 20ths of an inch it would have a definite meaning, but unfortunately 20 units of the scale cover a distance of as nearly as possible three-quarters of an inch. Therefore, each division on the scale equals exactly the tenth part of ¾ in., or roughly the 29th part of an inch.

We may be wrong, but this appears to us to have no relation to practical measurement in any direction. Had the divisions on the scale been marked in 20ths of an inch, we should have been able to read the elevation by treating the sight as a micrometer. Every complete turn being the 20th part of an inch, the 100th of an inch is the fifth of a turn. If we disregard the scale entirely, or make a fresh set of marks showing the amount of rise for each turn, we can soon relate the movement of the knurled collar to definite increments of elevation for any given rifle whose sight measurements are known. If we take 30 ins. as the distance which separates the Lyman backsight from the foresight, we find that this is exactly the 60th part of our 50 yards range. To make a correction of four inches at 50 yards, the sight requires to be raised the 60th part of this amount. This is ·067 of an inch. One complete turn of the screw being the 20th of an inch, viz., ·05, we see that the sight must be elevated one complete turn and 17·50ths of a turn, which, in round figures, may be expressed as 1 and 2-5ths turns. The amount of error in this approximation, viz., ·003 of an inch, being multiplied by 60 is equal to ·18 of an inch at 50 yards. This error is clearly so small that it may be disregarded.

The above illustration of a simple method of converting a screw adjustment into various corrections in minutes of angle can be applied to an infinite number of examples. To measure the rise per turn of the screw, and to find out how this is related to minutes of angle can be applied by any shooter to any rifle, and once he has taken note of the relation that exists, he can make any needful correction of aim with a very close approximation to the amount shown to be required by the behaviour of the rifle. In the example quoted we have shown that ·067 elevation produces a change of eight minutes of angle. It at once becomes apparent from this that a ·008 in. rise of the backsight represents one minute of angle. By the same system of approximation, we find that the sixth part of a turn of the Lyman screw (·008 goes into ·050, the rise per turn, six times), is the equivalent of one minute of angle when the sights are 30 ins. apart. Working backwards to find the amount of error that is involved in this approximation, we see that the sixth part of a turn raises the sight the 120th (one sixth of one twentieth) part of an inch. This is multiplied 60 times over the 50 yards range, and gives a correction of 7·2 ins. instead of the 8 ins. required. If we convert this into minutes we find that instead of the sixth part of a turn producing one minute of alteration in the angle, it produces ·9 of a minute, the error being thus a mere tenth of an inch for every 50 yards of range.

The same system of calculation can be applied to measuring the amount of lateral correction which is produced by a wind-gauge sight operated by a screw. To take the simplest available example, we will assume that we are dealing with a rifle of which the sights are 18 ins. apart, the wind-gauge screw making 50 turns to the inch, the range being 100 yards. One turn of the screw traverses the sight the 50th part of an inch. Eighteen inches goes 200 times into the length of the range. Therefore, a correction of 1-50th of an inch on the sight produces 200 times this amount of correction at 100 yards. Two hundred times the 50th of an inch is obviously four inches. The distance being 100 yards, this is the equivalent of four minutes of angle. Therefore, each quarter-turn of the screw produces one minute of a degree change of angle. Eight inches of wind at 100 yards, or for that matter, eight inches of lateral error on the sight, would accordingly be corrected by two complete turns of the screw. This very simple relation can be applied to every-day practice in a large number of ways. For instance, if the distance between the sights is approximately 18 ins., and it is found that a rifle fires 2 ins. to the right at 50 yards, then it is obvious that the foresight must be tapped over to the right by as nearly as possible the 100th part of 2 ins., which is ·02 of an inch. Now that the micrometer is so widely used the adjustment of the foresight by an amount so calculated, can be more readily effected than if the sight is moved by mere guess work, and the shooting is continued until the sights are progressively brought over the line of fire. With long experience it is quite possible that the mind might instinctively judge the amount of correction required, but as these notes are directed mainly to the education of the beginner, it is clear that the solution of the problem by simple arithmetic will hasten the acquisition of expert knowledge. As so many sights of the open character are approximately 18 ins. apart, a good all-round working rule may be established by saying that the sights should be corrected the 200th part of the error on the target for 100 yards shooting, the 100th part for 50 yards shooting, and the 50th part for 25 yards shooting.

These relations will be perfectly clear if the young gunmaker or other shooter regards his foresight as the pivot of a peculiarly modelled pair of scissors. The points of the scissors may be regarded as touching respectively the centre of the bull and a point on the target in line with the place where the shots are striking. The shorter end of the scissors may be taken to represent the distance between the two sights. It is then obvious that the distance separating the points of the scissors is greater than that separating their rear extremity by exactly the distance that the length of the range is greater than the distance between the sights. The latter is termed the sight base, and it is interesting to note that most sporting and miniature rifles have approximately an 18 ins. sight base. Military rifles run about 22, and the use of a Lyman sight on a sporting rifle increases the distance to just about 30 ins. By bearing in mind the fractional relation of these measurements to the length of the various ranges, the amount of multiplication or division that converts sight movement into correction of aim and *vice versâ* is easily ascertained and quite as readily committed to memory. Round number approximations should always be adopted, because the ultimate test must be that of actual firing.

FUMES FROM BLASTING EXPLOSIVES.

WE have received a copy of the report of the Royal Commission on the ventilation and sanitation of mines in Western Australia. Mr. E. A. Mann, the Government Analysist and Chief Inspector of Explosives, was a commissioner, and his report on the chemical aspects of explosives fumes is of such interest that we publish the following extract therefrom. The full text of the report is published under authority by Mr. W. A. Watson, Government Printer, Perth, W.A., price 5s.

In order to ascertain as far as possible the causes leading to the formation of fumes, a series of trial blasts was carried on under the following conditions:—By the courtesy of the management of the Kalgurli Gold Mines, Ld., certain "faces" were put at the disposal of the Commission to conduct blasts under any conditions they chose, the manager arranging for the faces to be cleared and re-bored as the tests proceeded.

Various firms dealing in explosives courteously put at our disposal cases of various nitro-glycerine explosives used on the Kalgoorlie field. The following matters were considered in arranging the details of the experiments:—

(1.) Effect of overcharging.
(2.) Effect of various sizes of detonators.
(3.) Effect of different ages of explosives.
(4.) Influence of tamping.
(5.) Effect of burying detonator in charge.

After the explosion in each case, entry was made to the face immediately, the operator for the purpose being provided with a fireman's smoke jacket, connected by a hose to the compressed air system of the mine. By this means, and carrying an electric lamp which would not be affected by the gases formed, access could be gained to the extreme end, and samples taken of the gases formed. Owing to the thick dust formed by the explosion, even the electric lamp was indiscern able by the operator when three feet away. As in all cases the operator could be in the face within two minutes of the firing of the last hole (and frequently sooner), it is evident that the gases in the face would be in a concentrated state, and would afford ample evidence of the presence of any deleterious compound which might be formed by the explosion. It is scarcely necessary to point out that, as varying quantities of explosives were employed, according to the nature of the rock, and as the ends used varied somewhat in shape and relation to the air currents, no importance was attached to the comparison of the absolute *quantities* of gases formed by the different explosions, but their relative *qualitative* value was of primary importance. Six different manufacturers were represented.

The samples were taken in rubber bags covered with silk, by means of a clean bicycle pump, and were taken to the laboratory and tested with as little delay as possible. Some criticism will possibly be evoked by the employment of rubber bags on account of the changes which occur in such a receptacle; but the advantages of these bags were so obvious when the samples had to be taken in semi-darkness by the sense of touch, and progress into and out of the end over broken ground would have been very risky with glass apparatus, that I determined to ascertain how far the method was reliable. To this end special bags were prepared, containing mixtures of CO_2, Oxygen, and CO, the mixture being tested by withdrawing samples after varying periods of time. Of the results of such tests the following will serve as an example:—

Time.	2.30 p.m.	3.30 p.m.	8.30 p.m.
CO_2 ...	8.8 ...	8.4 ...	7.4
O_2 ...	17.2 ...	17.6 ...	17.6
CO ...	5·6 ...	5·7 ...	5·2

It therefore appeared to me that, especially as the qualitative rather than the quantitative composition of the samples was required, that the bags could be used with safety, care being taken never to leave the samples longer than was absolutely necessary in contact with the bags. Samples were never left over night, and as a rule were tested within four to six hours of being taken. Of course the bags were quite unsuitable for retaining oxides of nitrogen, and only the tests made at the mine were relied on in this connection.

Several very interesting facts were disclosed by these tests, which may be summarised as follows:—

(1.) *Tamping.*—The results of tests and observations of work done did not disclose any reason to believe that the ordinary tamping was in any way insufficient, or gave rise to incomplete detonation.

(2.) *Overcharging.*—The amount of explosive judged necessary to lift the required burden was first decided, and then a large excess over this amount, sometimes two or three times the necessary charge, was inserted in the hole. Such overcharging was not found to affect the character of the fumes.

(3.) *Variation of Sizes of Detonators.*—All the detonators employed were new and in good condition. No difference was found in the results obtained by the use of different sizes of detonators which could be attributed to this factor only. This result was somewhat unexpected in the case of blasting gelatine fired by No. 3 detonator, and it would, I think, be scarcely safe to draw the inference that difference of detonator is immaterial, except within certain limits; the quality of the explosives in these two cases being perhaps particularly favourable.

(4.) *Age of Explosive.*—The explosives varied in age of manufacture over a period of two years and three months, *i.e.*, back to September, 1902, and this difference in age did not disclose any difference in result, showing that the supervision exercised has been sufficient to ensure that even old stocks in use are still of good quality.

(5.) *Brands of Explosives.*—No difference exists between the different brands of explosives used at Kalgoorlie as far as the character of the fumes produced are concerned. This fact I confidently expected, but it was not according to the opinions frequently expressed by irresponsible people.

(6.) *Fume Destroyers.*—No practical good was achieved by the use of fume destroyers beyond the laying of the dust caused by the explosion.

(7.) *Nature of Fumes.*—The fumes formed consisted always of Carbon Dioxide (CO_2), except in those cases where partial burning was suspected. CO was absent in *all* cases, or present only in such small quantities as to be impossible of detection by the methods employed, *i.e.*, in proportions less than ·1 per

cent. by volume.* Nitrous fumes were formed only when partial burning was suspected.

(8.) *Cause of Burning.*—No variations of treatment as above described produced any signs of burning, except that which consisted in inserting the detonator deeply in the primer, so that two or three inches of explosive covered the end of the detonator.

This test was devised in order to see whether the fuse by "spitting through" its covering would ignite a portion of the primer before reaching the detonator.† Such spitting would not always be liable to occur, and the fact that two of the tests conducted in this manner gave negative results seems to confirm the general conclusions drawn, viz., that this occasional "spitting" of fuse, combined with too deep an insertion of the detonator, is at least one cause of the production of fumes. The necessity for the simultaneous occurrence of both these conditions would seem to account for the comparatively rare occurrence of cases of nitric oxide poisoning.

In connection with the last paragraph, I would remark that one possible cause of burning remains uninvestigated. It has been suggested that one hole cutting out another in a face would be liable to ignite a portion of the charge in the latter. Such a theory is not capable of definite experimental proof, and I have not been able to obtain any data which would confirm. From general evidence, however, it would seem that this is certainly possible, and must rank with that just described as one of the causes of inflammation of the charge and subsequent poisoning of the workmen.

To summarise my conclusions:—

(1.) Fumes accidents are due to—

(*a.*) CO_2 accumulated as the result of thoroughly complete explosion.

(*b.*) Nitrous oxides or CO formed by partial burning.

(2.) These fumes cannot be traceable to defects in the explosives used or methods of handling, except as regards the use and storage of detonators.

(3.) That the difficulty is only to be removed by greater, more carefully controlled, and more scientifically distributed ventilation.

TRADE MARKS.

ADVERTISED. MAY 3—24, 1905.

270,481. A device representing an arm about to strike with a hammer, surrounded by the letters W. H. B. & Co. To apply to gun barrels. W. H. Butcher & Co., Birmingham, February 25, 1905.

271,371. The words GOOD LUCK To apply to explosive and blasting substances. Sprengstoffwerke Glückauf, Ag., Germany, March 23, 1905.

REGISTERED, APRIL 20—MAY 17, 1905.

269,837. Kynoch Ld.

* Since the above report was written, a most interesting paper has appeared which was read by Messrs. Thomas and Macqueen before the Institution of Mining and Metallurgy, in December, 1904, entitled "The Dust in the Air and the Gases from Explosives in a Cornish Mine." In this the writers give the result of a number of analyses of mine air after blasting, which disclose the presence of small quantities of CO in all cases.

† Evidence was given before the Commission that the detonator with primer attached is sometimes inserted in the middle of the charge. This statement was unverified; but such a practice would be highly dangerous, and any burning caused by the fuse as above would in such a case be an extremely serious matter, giving rise to large volumes of noxious gases.

APPLICATIONS FOR PATENTS.

APRIL 25—MAY 20, 1905.

8,693. Sighting Ordnance. A. W. Ryland.
8,718.* Firearms. M. F. Smith. (Date of application in U.S.A., April 27, 1904).
8,731.* Firearms. R. Frommer.
8,741. Torpedoes. F. McD. Leavitt.
8,746.* Explosives. L. Thomas. (Date of application in Italy, December 12, 1904)
8,762. Shooting Spectacles E. Clarke.
9,046. Projectile Fuses. H Stanbridge, W. Walker, and H. J. Davison.
9,346. Small-arms. A. E. Dakhyl and A. Galanti.
9,374. Air Guns. W. Field.
9,379.* Automatic Pistols. J. Warnant.
9,391. Rifle Sights. A. L. Winser.
9,446. Cartridge Cases. The Metals Corporation, Ld., and S. Cowper-Coles.
790A. Gun Laying. The British Thompson-Houston Co., Ld.
9,650. Gas Checks. T. Gilbert-Russell.
9,663.* Miniature Rifle Ranges. C. P. Markham.
9,787.* Telescopic Sights. W. Youlten. (Date of application in U.S.A., May 9, 1904).
10,015.* Transported Ordnance. Fried. Krupp. (Date of application in Germany, July 25, 1904).
10,072. Revolvers. W. J. Whiting.
10,108.* Small-arms. G. Daningie
10,140. Ordnance. W. Millin.
10,162.* Percussion Fuses. Fried. Krupp, Ag. (Date of application in Germany, July 30, 1904)
10,177. Primers for Ordnance. J. W. Graeme and R. W. McNeely.
10,179. Miniature Rifle Range. W. T. Vicary.
10,207. Miniature Targets. C. J. McCoan
10,284.* Targets. J. W. Reid.
10,317.* Torpedoes. C. A. F. Cloes (Date of application in Sweden, May 19, 1904).
10,361.* Sights. F. D. Hopkins.
10,411. Air Guns. M. Pulverman. (Agent for *F. Langenhan*).
10,426. Air Guns. L. Jeffries.
10,438. Small-Arm Sighting. F. J. Beal.
10,453.* Grenade Shell. W. J. Fowler.
10,478.* Torpedo Launching. A. E. Jones.
10,480. Night Sights. G. A. Bertalot (Agent for *T. Bonino*).
10,521. Detonators. G. F. Beritner.
10,540. Projectile Fuses. J. F. Meigs and E. A. Guthmann. (Date of application in U.S.A., May 21, 1904).

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

MAY 4—25, 1905.

COMPILED BY HENRY TARRANT.

6,118 (1904). **Automatic Rifle Mechanism.** J. J. Royden, Liverpool (Agent for *Capt. A. Cei-Rigotti, Italy*). An automatic rifle, in which the mechanism is actuated much in the known way by the gases of explosion, is described in this patent. The continuous discharge of all the cartridges in the magazine is prevented by a part which holds the striker after each discharge until the pressure upon the trigger is relaxed. The mechanism is so arranged as to obviate danger to the shooter's face. Accepted April 12, 1905.

8,759 (1904). **Shortened Magazine Rifle.** H. and C. Gamwell, Liverpool. In order to retain the present length of the shortened service rifle, whilst preserving the old length of barrel, the breech mechanism is situated in the top of the butt. The barrel passes through the grip of the stock. The magazine of the present rifle is double in capacity. When one side is empty the other is turned so that it is in position to feed its contents into the breech. Accepted April 13, 1905.

9,461 (1904). **Range Variation Indicator.** A. T. Dawson, London and J. Horne, Barrow-in-Furness. An instrument actuated by clockwork capable of imparting an automatic

movement constant to the speed to which the instrument is set. The relative speed or change in position between gun and target is shown by this instrument, and the change in range may be easily observed by the gun layer from its dial. The range is first observed and the instrument set to the range and to the speed at which the ship is travelling Accepted April 20, 1905.

9,462 (1904). **Semi-Automatic Ordnance.** A. T. Dawson and G. T. Buckham, London. The mechanism of semi-automatic guns described in Patents Nos. 26,382, 1901, and 5,663, 1903, is modified, so that the striker may be repeatedly cocked without opening the breech; so that by an arrangement of the cam actuating spring-controlled pawl, semi-automatic guns may be worked as ordinary quick-firing guns; and so that the plate which closes the recess occupied by the striker may be made to occupy its correct position before firing. Accepted April 25, 1905.

9,462A (1904). **Mounting for Recoiling Ordnance.** A. T. Dawson and G. T. Buckham, London. In order to counteract the tendency of the gun and cradle to move about the trunnions under the influence of the longitudinal displacement of the centre of gravity of the system when the gun recoils, a spring-plunger—wedge-shaped at the bottom—is carried into contact with a groove in the pedestal during the recoiling movement. Accepted April 25, 1905.

10,262 (1904). **Ordnance Sight Setting.** Professor G. Forbes, F.R.S., London. With the range-finder described in Patent No. 5,267, 1901, the patentee combines a sight setter, or range corrector, which is designed to comply with certain laws that he has discovered regarding necessary corrections to elevations caused by variations in muzzle velocity and air resistance. Accepted April 20, 1905.

11,700 (1904). **Sights for Night Use.** D. Abercrombie, Manchester. Apparatus adapted to throw a beam of light to a distance at least equal to that at which the gun is to be used, is set out in this specification. The axis of the beam of light is about parallel with the axis of the barrel, so that the illuminated object will be struck by the bullet. The light emanates from an incandescent lamp supplied with current by a battery situated in the stock of the gun. Accepted April 20, 1905.

12,624 (1904). **Small-arm Discharge Indicator.** L. B. Willoughby, London. An indicator for sporting guns, by means of which the number of cartridges discharged is automatically recorded. The indicating mechanism is situated in the forepart, and is actuated by some portion of the gun, which serves to effect the discharge. A separate indicating device may be applied to each barrel. Accepted April 6, 1905.

12,715 (1904). **Ordnance Firing Mechanism.** Sir W. G. Armstrong, Whitworth & Co., Ld., and S. M. Murray, Newcastle-on-Tyne. The lock frame which slides at right-angles to the obturator stem in the firing mechanism of ordnance, is provided with cam surfaces adapted to take hold of the tube head and to eject the tube. A trigger is provided to retain the striker in the cocked position, and a lever arm and spring tripper bolt combination for actuating the striker. Accepted April 13, 1905.

12,735 (1904). **Short Base Range Finder.** H. D. Taylor, York. A short base range finder, in the construction and working of which is applied the property of glass refracting prisms bounded by plane refracting surfaces. The increment in deviation consequent upon such a prism swinging from its position of minimum deviation, which swinging is employed to neutralise the parallax consequent upon viewing the object from the two ends of the base line, is measured by the revolutions of a screw, and so becomes the measure of the required range. Accepted May 4, 1905.

12,746 (1904). **Gun Carrier for Cycles.** J. B. B. Hill, Worcester. A sporting gun-case, adapted especially to be conveniently attached to the frame of a cycle. When opened the case exposes a long pocket on one side designed to receive the barrel and cleaning rod, and upon the other side a pocket for the stock, and another for cartridges. This construction balances the case when it is suspended by straps from the top bar of the frame of the cycle. Accepted April 13, 1905.

12,893 (1904). **Range Finder.** Capt. J. T. Dreyer, R.A., Woolwich. A range finder, consisting of a telescope furnished with a diametrically divided object glass. When the object is correctly sighted the relative position of these two parts of the glass is indicated by a scale from which the range may be taken. Accepted April 27, 1905.

13,840 (1904). **Cartridge Belt.** Lieut.-Col. J. H. Patterson, Colchester. Cross loops are so arranged at intervals upon the cartridge belt as to allow the bases of each clip of cartridges to overlap the bullets. A large number may in this way be safely carried. The loops which hold the cartridges are secured to the belt by means of studs. Accepted May 4, 1905.

14,587 (1904). **Range Finder.** D. Clerk, London (Agent for *J. G. Stewart, South Africa*). A range finder, consisting of a casing possessing a binocular opening. Pivoted within the casing are tubular holders provided with mirrors. The movement of the mirrors in sighting the object is transmitted to gearing, through which dials on the front of the casing are caused automatically to indicate the range. Accepted May 4, 1905.

16,280 (1904). **Breech Mechanism of Ordnance.** A. H. Emery, U.S.A. In order to facilitate rapid loading of ordnance, the powder gases are expelled from the bore immediately after firing, and before the breech block is removed, by the introduction of compressed air. The breech block of the gun described possesses a continuous screw thread, and is released from the corresponding thread on the breech casing by the outward movement of the latter, which is divided up into a number of segments. Accepted May 4, 1905.

20,781 (1904). **Ordnance Sighting Apparatus.** C. D. Abel, London (Agent for *Rheinische Metallwaaren-und-Mf., Germany*). By means of the sighting apparatus described in this Patent the correction rendered necessary by the lateral deviation of the projectile is automatically effected for all ranges. The sighting apparatus applies to those guns in which the line of sight is independent of the elevating motion of the gun; and where fixed sights are used the foresight is made automatically to compensate the deviation. Accepted April 27, 1905.

22,975 (1904). **Ordnance Sighting Apparatus.** C. D. Abel, London (Agent for *Rheinische Metallwaaren-und-Mf., Germany*). The sighting apparatus described in the above-mentioned Patent No. 20,781, 1904, for correcting lateral deviation of the projection, is widened in the scope of its usefulness by extending its corrective powers to the lateral deviation of the projectile which occurs when the gun is standing upon inclined ground—*i.e.*, when one wheel is lower than the other. Accepted April 27, 1905.

1,664 (1905). **Range Finder.** H. Wild, Switzerland. A double image range finder capable of correction without the aid of a known distance. The instrument possesses a base determined by two angle mirrors and one telescope objective. Errors arising from the small differences in position of the principal sections of the reflecting devices may be corrected by returning the reflecting devices which determine the base into their original position. Accepted April 13, 1905.

1,807 (1905). **Sighting Attachment for Ordnance.** Fried. Krupp, Ag., Germany. A sighting attachment with curved attachment bar and a sighting device for laying the sighting line is designed to obviate the length to which the bar had heretofore to be drawn out for high elevations. This is done by making the device swing relatively to the attachment bar in the vertical plane which cuts the sighting line, and the length of the bar corresponds to an angle which is less than the greatest angle of elevation for which the attachment is to be used. Accepted April 27, 1905.

2,417 (1905). **Ordnance Ammunition Case.** Fried. Krupp, Ag., Germany. In connection with receptacles for ordnance ammunition, rubber rings are provided which are held in the framework of the receptacle by their own elasticity and so may easily be removed. The rings are so shaped that they possess bearing surfaces similar in form to the points of the projectiles which they are adapted to support. Accepted April 13, 1905.

3,338 (1905). **Ordnance Mounting.** Fried. Krupp, Ag., Germany. In barrel recoil ordnance in which the barrel of the gun may be elevated either together with, or independently of, the upper carriage, the axis about which the barrel of the gun is elevated independently of the carriage is constructed so that it is located near to the breech end of the barrel. A strut is situated near the muzzle and is so connected with the barrel and with the slide so as to be easily detachable. Accepted April 13, 1905.

3,429 (1905). **Small-Arm Projectile.** Deutsche Waffen-und

Munitions-Fabriken, Germany. Investigations by electric spark photography has enabled the patentees to solve the question as to the most favourable form of projectile head for high velocities. The head is equal to about half the total length of the projectile and is curved to a radius equal to from four times to nine times the calibre. The length of the cylindrical or guiding portion of the bullet is made equal to 1·85 times the calibre; the length of the head (*i.e.*, from the point at which the diameter begins to decrease to the tip of the nose) equal to 2·19 times the calibre; and the mean radius of curvature of the pointed head 4·7 to 8·2 times the calibre. Accepted April 13, 1905.

3,789 (1905). **A New Explosive**. The Marquis Roberto Imperialli, Italy. A new explosive is destribed in this Specification. It is claimed to possess considerable resistance to mechanical shocks, strong chemical stability even at high temperatures, and perfectly non-hygroscopic qualities. The explosive has been christened "Picrite," and consists of nitrate of potassium, nitrate of barium, and picric acid in about the following proportions. Nitrate of barium, 20 parts; nitrate of potassium, 40 parts; and picric acid, 40 parts. These compounds are thoroughly ground and when reduced to a very fine powder are mixed until a uniform mass is produced. The explosive melts at 115° C. It is capable of withstanding the action of heat without noticeable alteration until 250° C. is reached. It does not explode under the action of heat alone below 360° C. Accepted May 4, 1905.

4,735 (1905). **Ordnance Sighting Gear.** Fried. Krupp, Ag., Germany. In ordnance having a screw elevating gear and sighting mechanism adjustably mounted upon the cradle, the turning of one hand wheel is made to effect both the rotation of the screw of the elevating gear and of the adjusting gear of the sighting mechanism. The ratio of transmission is such that the gun and sighting device are moved through the same angle but in opposite directions. Accepted April 13, 1905.

4,626* (1905) **A Trigger Guard Cover**. A. P. Doig, Dundee.

5,327* (1905). **A Projectile for Small-Arm**. Fried. Krupp, Ag., Germany.

5,328 (1905). **Ordnance Breech Mechanism.** Fried. Krupp, Ag., Germany. On the arm of the operating lever, which engages a cam groove in wedge breech mechanism for ordnance, an abutment is provided to relieve the pivot of the operating lever of the shock of discharge. Accepted April 20, 1905.

* These Specifications are more fully described under "Selected Patents."

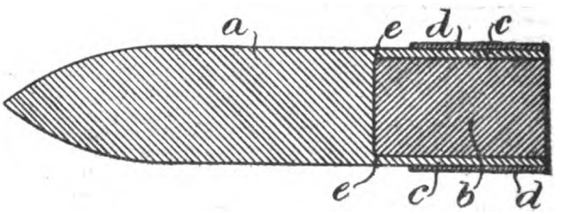
SELECTED PATENTS.

STEEL PROJECTILE FOR SMALL-ARMS.

5,327 (1905). Fried Krupp, A.-G., Germany. A projectile for small-arms is described in this patent specification. The projectile consists mostly of steel, but has a hollow space filled with a specifically heavy metal. Such a bullet, it is claimed, possesses specially high penetrative power, and on account of its simple construction is easy and cheap to manufacture.

The appended drawing illustrates a section of the bullet *a*, which is composed of steel. At its rear end a hollow space *b* is formed of such internal diameter that only a thin steel wall *c* is left. The thickness of the wall, for instance, in projectiles intended for fire-arms of a calibre of 7·7 millimetres would be about 0 5 to 0 6 millimetres. The space *b* is filled with lead or with some other heavy metal and it extends so far forward as to leave in front of it a substantially cylindrical portion of the projectile and its nose. The hollow portion of the projectile is wholly or partially covered with a jacket *d* of copper, nickel, or other soft metal. This jacket is designed to take the grooves of the rifling.

When a projectile of this description strikes the protecting shield of a field gun, the filling *b* is upset in the direction of flight, and is caused to burst the thin steel walls *c* and the driving band *d*. These are separated from the solid portion of the bullet at points marked *e* almost simultaneously with the impact. The solid portion *a* continues its flight, and the burst off part *c* with the jacket *d* and the filling *b* remains either jammed in the shield or falls in front of it. Thus during nearly the whole penetrative



movement the penetrative force is equal to the kinetic energy of the complete projectile. The solid portion of the bullet continues on its way behind the shield with only slightly diminished velocity. The original form of the bullet is retained after passing through the bodies of human beings or animals. Accepted May 4, 1905.

TRIGGER GUARD COVER.

4,626 (1905). A. P. Doig, Dundee. To prevent accidents which frequently occur in consequence of the comparatively exposed position of the triggers of sporting guns, the patentee has invented an elastic covering for the trigger guard.

It is illustrated in the accompanying drawings. Fig. 1 represents a longitudinal section; Fig. 2 a plan; and Fig. 3 view of the

Fig. 1

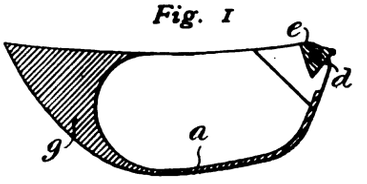


Fig. 2

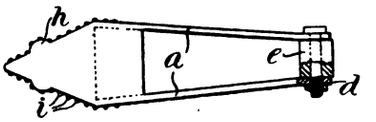
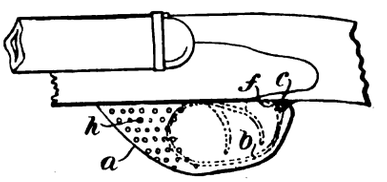


Fig. 3



cover as attached to the gun. It consists of an india-rubber trough-like device, the inside of which is formed to comply with the shape of the trigger guard *b*, over which the cover is "sprung." The cover is hinged at *c* to the guard *b* by means of a pin *d* passing through the sides of the cover and through the triangular piece *e* which fits into the triangular space *f* formed by the claw of the trigger guard. The parts of the cover through which the pin passes are so protected as to prevent stretching around the holes. The front part of the cover *g* is made solid and extends somewhat in front of the guard. It is provided with ribs and studs at *h* and *i* to facilitate the removal of the cover from the guard. The cover is first hinged when applying it to the guard, and the part *g* is then sprung over the front of the guard. Its elasticity retains it in position. Accepted May 4, 1905.

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CONTENTS.

CURRENT TOPICS.

War Office Patentees.—The recent appointment of Dr. Ashton to be Superintendent of the Royal Small Arms Factory at Enfield Lock brings to mind the urgent need for settling on some enduring basis the policy which should be adopted towards inventions hatched in Government factories. Dr. Ashton is of an inventive turn of mind, and it would accordingly prove no surprise if he should register in the form of patents any improvements which may result from investigations he may from time to time carry out on behalf of the Government. In the case of the "Speed" sight we have an excellent object lesson to guide our views. The War Office required a military sight having a screw movement, both up and down and sideways in addition to the coarse adjustments provided by the notched stem of the folding leaf. There is probably no competent machinist in the country who could not devise a perfectly effective means of complying with this specification. Patents on such a subject so overlap one another that the claim of original subject matter in any given device must be reduced to a mere description of a combination. In fact the more modest the claim the more certain it is to go through. The Government probably gets the use of the device, either free or by payment of a nominal gratuity. The sight is then sealed for service use. Consequently, anyone who desires to make the service sight and sell it to the general public must be infringing the patent which has been taken out, and as there can be only one service sight the patentee may charge whatever royalty he likes. This involves a serious grievance, and the remedy rests with the Government, who could very easily arrange that any patented articles sealed for service use should at least be as free to the English manufacturer supplying private customers as it is to foreigners. Among the many abuses which our English patent law renders possible this, in our opinion, is one of the most serious.

The Preservation of Rifle Barrels.—Dr. Hodgkinson's confirmation of the views expressed in these columns last month concerning the chemistry of rust and his very interesting expansion of the more technical views involved add yet another stone to the structure of exact theory in this important department of gunnery. Although no remarkable novelty can very well be claimed for the views put forward, we are faced by the extraordinary circumstance that until Dr. Hodgkinson interested himself in the question we all vainly endeavoured to keep our rifles clean with oil. The gunmaker in his own practical fashion applied correct theory by swilling the barrel out with boiling soda water. The Government and most of the manufacturers of rifle cleaning preparations certainly introduced a proportion of alkaline material into their cleaning oils; but it was Dr. Hodgkinson who appreciated the fact that the proper vehicle for carrying the alkali into the fouling was water. His letter shows how deep is the knowledge which enabled him to see so clearly what others had failed to appreciate. Although the outcome of the Doctor's researches is now a proprietory article known as "Fluor Oil," we have no hesitation in applying to it a degree of praise which, while doubtless of commercial benefit to the vendors, is none the less justified by its extraordinary merits. Shot-gun powders leave their own deposit of alkaline

material in the fouling left in the bore. With rifles this is more difficult to accomplish. Consequently, the existence of a material which makes rust impossible is a boon to every user of the rifle. The extraordinary circumstance that the galvanic action which takes place between any metallic fouling that may be present and the gun barrel, is so affected by the presence of an alkali that the material attacked is the fouling and not the barrel, affords yet another evidence of the scientific appropriateness of the new preventative of rust.

The New Guide Book.—In our review of the new *Guide to the Explosives Act*, it will be seen that the old title of this most useful handbook has been slightly altered as an accompaniment to the change of authorship. The late Sir Vivian Majendie received great credit for the earlier issues of this book which ran through no less than eleven editions, representing a total issue of 11,000 copies. When the last issued edition went out of print, it became apparent that its usefulness could be greatly enhanced by a thorough-going revision of many of its chapters. The responsibility for making these changes naturally rested with Capt. Thomson, the chief inspector, and he appears to us to have acted wisely in adopting the responsibilities of its authorship. There is, of course, a limit in all cases to the amount of revision which can be applied to a standard work after the author is dead, and Capt. Thomson no doubt appreciated the undesirability of making these changes under the signature of one who is no longer with us to sanction them. The altered shape of the book, the copious notes and directions, and the general arrangement of the text, show us that we have in Capt. Thomson what we hardly thought possible years ago, that is a successor to the late chief inspector, with an encyclopædic knowledge of the Act which we considered could only be acquired in the course of a life-time's study. That Capt. Thomson knows what he does is greatly to his credit, and those whose business is controlled by his administration of the Act will feel glad that the junior inspector of some ten years or so ago has made such excellent use of the intervening period. Trade in Great Britain is in the nature of things restricted by a large amount of legislation, and it is only when that legislation is intelligently administered that successful commerce is possible. In the Pistols Act we have an example of a piece of legislation which seems to have been framed for the express purpose of injuring legitimate trade, and it unfortunately contains no provisions for adapting the regulations to the requirements of the moment. If the Pistols Act had been framed on the lines of the Explosives Act, and its administration placed under the control of the explosives department of the Home Office, the existing grevious state of affairs would never have come about.

Explosives as Fishing Bait.—Those of us who diversify the routine of a seaside trip by a day's fishing over a heap of rocks or sunken wreck, will feel sympathy with the Cornish fishermen, who deplore the injury caused by the dogfish. To expect the tug of one's line to be followed by landing a flapping plaice, a rock whiting, or even a small cod, and to pull into the boat a nasty creature with a bulldog's mouth and a crocodile's body, is by no means pleasant. There is uncanniness about the dogfish, which makes one long to heave it overboard out of sight; but the fisherman, if there be such on board, generally reserves the dogfish for his own eating, explaining that when dressed and cooked in a certain way, it makes excellent eating. When the dogfish assumes monster dimensions and multiplies to such an extent that the profits of sea-fishing are diminished by his capacity to break the nets, the problem becomes a more serious one. This explains the agitation which is now proceeding to secure sanction for the use of explosives for killing these fish in the places where they most congregate. The action of an explosive on a fish seems to be to injure the structure of the air bladder by which the degree of buoyancy is regulated. Even a rifle bullet driven through the water in the region of a fish will cause it to come to the surface upside down. This, of course, is a most unsportsmanlike form of poaching; but when applied to vermin it is justifiable so long as the injury done can to some extent be confined to the harmful inhabitants of the water. To cover a part of the cost of treating dogfish in this manner, it is suggested that the railway companies should provide extra cheap carriage for these creatures in order to facilitate their distribution among the poorer classes. Whatever may be the outcome of the present agitation, it is at least certain that the narrators of fish stories will greatly enlarge their horizon.

The Rifle Club Appeal.—When a soldier of Lord Roberts' experience pledges his reputation on the necessity of a considerable extension of the rifle club movement, we can at least be certain that the accomplishment of his desire will prove of national usefulness. Pessimists have asserted that a lot of rifle club members snapping at the enemy from behind hedgerows would soon lose their enthusiasm after a few of them had been shot for not belonging to a properly organised force. This may cause doubt as to whether we have been right in devoting so much attention to an apparently useless ambition. We, for our part, have always thought that although a particular group of rifle club members may be middle-aged men unlikely to rank as able combatants in a regular force, the fact that they have learnt shooting is nevertheless of national importance in so far that the rifle-shooting instinct has been ingrained in them, and their example may be followed by friends, relations and children, who do not suffer from the physical disadvantages of middle age or sedentary life. If the extension of rifle clubs serves no better purpose than the removal of parental anxiety, which has hitherto caused fathers and mothers to discourage all kinds of shooting on the part of their children, good of a definite kind is done. The child wishes to shoot, and if the father can be converted from an opponent to an advocate, the youngster will not be long in possessing the object of his dreams, whether it be an air-gun, a miniature rifle or a full-blown service weapon. The miscellaneous thousands who volunteered for the late war contained amongst their number many who were hopelessly inexperienced as rifle shots. This would not have been the case had facilities for rifle practice existed in the manner advocated by the late Commander-in-Chief. A fair degree of proficiency in rifle-shooting is exceedingly easy of attainment, and as keenness develops with every shot fired, it is not long before a youngster may become so accustomed to the handling of the rifle as to overcome the natural tendency when taking part in serious warfare to blow off the rifle without regard to the direction in which it is pointed.

WIND DEFLECTION.

WE print in this issue another letter relating to the much discussed subject of the influence of wind on a projectile. We have carefully read our correspondent's letter, and must confess that while his re-statement of the subject is exceedingly lucid, it leaves us where we were as regards the scientific basis of Younghusband's formula, which still awaits demonstration. If we cast a large steamer loose from the landing stage in a strong tideway, we do not expect it to float with the tide at the end of half a second. In the same way the bullet does not deflect the full movement of the wind during its period of travel. Now it seems to us that the simplest basis of reasoning would be to assume that if the bullet lay long enough in the air it would in time adopt the same rate of movement as the wind. Therefore, what we want is a formula that will give us a correct method of calculating the wind deflection based upon the measured factors of side sectional area, skin resistance, side sectional density, velocity of bullet and wind, period of flight, and so forth.

The Younghusband formula, as explained by our correspondent, appears to reproduce the conditions of a well-known arithmetic problem for boys. We have a snail crawling up a wall, and it progresses at the rate of one foot an hour. If we apply the Younghusband principle to analysing its movement, we should say that its true rate of progress is three feet an hour, and that all the while it is travelling forwards it is also slipping backwards. Consequently its true rate of movement can only be scientifically examined by assuming that it moves up the wall three feet an hour, slips back two feet an hour, leaving a net progress of one foot an hour. The obtaining of a correct result does not necessarily imply a correct scientific basis of calculation. In the case of the bullet we want to know what proof exists that the slipping backwards is accompanied by crawling forwards. For the moment we cannot help feeling that our columns have contained no proof of the partly neutralising movement that is said to occur. We are accordingly entitled to our belief that the correct result given by the Younghusband method is no more than a coincidence. If some leading mathematician would set to work to build up a formula containing the factors already stated, harmonised upon the assumption that the bullet does not travel up wind, but drifts down wind with a speed gradually approaching that of the medium through which it travels, results might be obtained quite as consistent as those experienced with the Younghusband formula. No one has yet satisfactorily answered our query as to the proper time that a bullet would take to attain the full velocity of the side wind through which it travels. We know a balloon moves with the wind, also a submarine with the tide, but both these objects are immersed in the medium for a time greatly exceeding the two seconds of a bullet's total flight. It is not our wish to cast down a useful structure without being prepared to set up something in its place. We accordingly abide by our adoption of the Younghusband method as giving good practical results, but what we do feel is that, in spite of the difficulties of obtaining exact measurements of deflection for a variety of bullets passing through properly estimated air currents, sufficient exact knowledge might be collected to warrant the examination of the subject upon the altered basis here recommended.

THE CHEMISTRY OF RUST.

SIR,—The rusting of iron to which you refer in a short article in a late number of *Arms and Explosives* is a subject in which I am much interested.

It is not exactly a simple matter from a chemical point of view. May I mention some of the causes of rusting, and the chemical actions going on.

Iron and steel are observed to rust when exposed to ordinary air, or when immersed in ordinary water. In pure dry air and pure distilled and well-boiled water, iron does not rust or change, as has been shown by experiments continued for many years. Two or three substances may be present in ordinary air or in rain water. They are carbon dioxide, nitrous acid, and hydrogen peroxide, any one of which is capable of rusting iron somewhat rapidly unde ordinary conditions. In the presence of an alkaline substance, such as ammonia or soda, or lime, neither the substances mentioned nor any other, seem capable of oxidizing or rusting iron.

The condition for oxidation is the presence of an acid substance, very minute quantities of which are sufficient. Most ordinary conditions are of this kind.

Air, and moisture deposited from it, and all natural waters contain carbon dioxide, which forms carbonic acid with the moisture. This acid actually dissolves iron, hydrogen being liberated and a carbonate of iron formed. In exposure to air this undergoes further changes, one of which is the formation of red rust and another the liberation of carbonic acid which in turn attacks another portion of iron.

Nitrous acid is sometimes present in air. It is always produced when guncotton, cordite, or similar propellants are exploded. It is therefore always found in a rifle or gun tube after firing.

Its genesis seems to be after this order: Some nitric oxide ($N_2 O_2$) or (NO) is formed during the burning stage of these explosives. On contact with air this becomes $N_2 O_4$ (or perhaps $N_2 O_3$) and with moisture these substances combine to form nitric or nitrous acids (HNO_3 and HNO_2). Of these the more virulent is the nitrous, because it does not act like most other real acids on metals, but starts an oxidizing action on the metal, reproducing in so doing the same oxide of nitrogen (NO) which, on contact of air and moisture, starts on another cycle of operations. This action can best be shown by the usual chemical equations

$$2\,H\,NO_2 + Fe = FeO + H_2O + {}^2(NO) + {}^2(NO) + \text{air}$$

again makes

$$H\,NO^3 + H\,NO^2.$$

This substance is nearly the worst enemy of iron taking into account the small quantity necessary to start and continue operations. After these comes hydrogen peroxide which under *acid* conditions very rapidly oxidises iron. Under alkaline conditions the hydrogen peroxide can scarcely exist and when quite pure and neutral it has no action on iron.

Most other metals in contact with iron set up galvanic couples and if the conditions be moist and acid the iron suffers. *Under alkaline* conditions iron is in nearly all cases the elected negative element, that is not acted upon, whilst the other metal or element in contact is acted upon or corroded.

Ordnance College, Woolwich. W. R. HODGKINSON.

THE WIND PROBLEM.

SIR,—Your correspondent, "Enquirer," is by no means singular in finding a difficulty in understanding the explanation of the wind problem as stated in the method which I adopted when putting my ideas before you some two months ago. Although I cannot see a means of explaining away any of the difficulties which my method of speaking of the subject may have brought into prominence, I am happy to say that my brother Mr. J. A. Hardcastle, F.R.A.S., has been able to suggest a new set of words whereby the simplicity of the physical problem may be understood more clearly.

For the understanding of it let us leave elongated and rifled projectiles alone and consider the elementary case of a spherical ball projected from a smooth bore gun into a cross wind of known velocity 20 f.-s. at an initial velocity of 2,000 f.-s.

Suppose the range of the target is 1,000 yards, it is clear that if there were no air the time of flight would be

$$\frac{s}{v} = \frac{3{,}000 \text{ feet}}{2{,}000 \text{ f.-s.}} = 1{\cdot}50 \text{ seconds.}$$

If the observed time of flight is 2·30 seconds, the delay in point of time of the projectile would be

$$2{\cdot}30 - 1{\cdot}50 = 0{\cdot}80 \text{ seconds,}$$

all of which would be due to the resistance of the air.

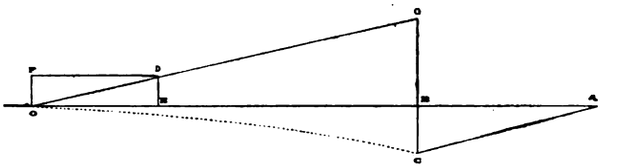
Further, it requires no particular argument to show that the air moving across the range during the period of delay already defined as 0·80 of a second at the defined velocity of 20 f.-s., travels a distance of $0{\cdot}80 \times 20 = 16$ feet to leeward. Capt. Younghusband's formula states that the deflection due to the wind is $W(T-t)$ feet, where W is the speed of the wind in f.-s., T is the time of flight in air, and t is the time of flight in vacuum, which formula agrees with the plain English that the deflection due to a cross wind is equal to the speed of the wind multiplied by the delay in time due to the existence of the air.

As a further help it might not be out of place to point out that if there were no air there would be no wind, and that if there were no wind there would be no deflection or delay due to the presence or movement of the air. Also if the projectile had infinite weight there would be no retardation and there would be no delay or deviation, and the heavier the projectile the less the delay and the deviation as is well known.

Turning to the classical authority of Didion, we find in his *Cours Elémentaire de Balistique* (Paris, 1859), on page 27, a few pregnant words which leave the subject to speak for itself. The following is a translation of paragraph 29, entitled *Déviation due au vent*:—

"Among the influences which cause a projectile to deviate during its passage through the air, that arising from the movement of the atmosphere, or wind, is the easiest to evaluate, particularly in regard to spherical projectiles fired at a small angle with the horizontal. To be more precise it is easy to see for a start that the deviation increases with the velocity of the wind, and that it should be proportional thereto: in like manner the deviation increases as the action of the air on the projectile becomes greater, the mass remaining the same. This action is clearly measured by the increased duration of the projectile's flight through the air by comparison with the same movement through a vacuum. The deviation will, therefore, also be proportional to the difference between the times of flight through air and through vacuum. It is clear from this reasoning that the lateral deviation of a projectile at a given distance is equal to the difference between these two times multiplied by the wind velocity. That is to say, it is equal to the ground passed over by the current of air in the time represented by this difference." He continues by writing down the formula which we know as Younghusband's, and gives a single numerical example.

To demonstrate the precision of his reasoning let us suppose the gun to be at O and the target 1,000 yards away at B.



Make O A equal to the range in vacuum 4,600 feet due to an initial velocity of 2,000 f.s. and a time of flight of 2·30 seconds. Then A B is 1,600 feet and is the delay in range due to the existence of the air. Let G B C be the deviation of a 20-f.s. wind at right angles to the range, and let B C be the deviation due to that wind which is required to be found. In the triangle A B C the side A B and the angle A B C are known. If the angle B A C can be found, the triangle A B C is solved and B C is known.

Draw the parallelogram O E D F so that O E : O F : : 2,000 : 20, that is as the initial velocity is to the velocity of the wind. Then by the parallelogram law, D O represents in magnitude and direction the velocity of the projectile through the air as it leaves the muzzle. This velocity is the cause of the retardating force.

By Newton's second law of motion "change of motion is proportional to the impressed force and takes place in the direction of the straight line in which the force is impressed." The change of motion with which we are concerned is the change due to the retarding force of the air and the angle along which that force is impressed is the angle D O E, so the angle B A C must be equal to the angle D O E and the triangle A B C is solved.

D E : E O : : 20 : 2,000 : 1 : : 100

so that B C : A B : : 1 : 100

and since A B is 1,600 feet, B C is 16 feet. This is the result given by Didion's or Younghusband's formula.

In my original statement I made the bullet arrive at the point C by the path O G through the air and the path G C parallel to the motion of the air over the earth, and now we make it arrive at the same point C by the path O A in a vacuum and a path A C parallel to the line of action of the retarding force of the air. Looked at from either point of view the path of the projectile over the earth is the curved path O C, and the number of minutes in the angle B O C is the deflection to be given on the sights. What Younghusband did was to show that Didion's formula held good also in the case of an elongated rifled projectile. The effect of the rifling is to make the projectile expose the same cross-sectional area continually to the air and fly point first through the air. A spherical projectile always exposes the same cross-sectional area to the air, so that strictly we should not speak of Younghusband's solution of the wind problem, but give the credit of the solution to the French General of Artillery, viz., Didion.

J. H. HARDCASTLE, Capt.

ELEY'S 1905 CATALOGUE.

THE new Eley catalogue and price list contains several items of special interest, none more so than the following table, which gives the standard loads recognised by Messrs. Eley and the powder makers as giving the best results in guns of standard boring:—

Cartridge.	42-grain Powders bulking to 3 drams, *i.e.*, Schultze. Amberite, Eley Smokeless and Cannonite.		33-grain Powders, *i.e.*, E.C. No 3, Empire, Imperial Schultze, and Diamond Smokeless.	
	Powder grs.	Shot oz.	Powder grs.	Shot oz.
10-bore 2⅝ in. ..	49	1⅛	40	1⅛
12 ,, 2¾ ,, ..	47	1¼	38	1¼
12 ,, 2½ ,, ..	42	1⅛	33	1 1/16
16 ,, 2½ ,, ..	36	1 1/16	30	⅞
20 ,, 2½ ,, ..	31	1 1/16	26	¾

With shot larger than No. 3 the charge of powder increased 5 per cent.; with shot smaller than No. 7 the charge of powder and shot decreased 5 per cent.

It will be seen that for the first time the various 42-grain powders are grouped under one heading and treated as requiring the same combination of charge for every bore. The 33-grain powders are similarly classified under an appropriate heading. Consequently, we find in this table an end to the extraordinary custom which has hitherto prevailed of regarding different powders in the same group as requiring different charges for bores other than 12, all the while that they are all regulated for the same charge of powder and shot in the standard bore. In regard to the two classes of powders named, it will be seen that the 42-grain powders are regarded as suitable for the 1⅛ oz. charge, whereas 1/16 oz. less shot is regarded as the appropriate equivalent for the 33-grain powders. This system of treatment is adopted for 12, 16, and 20-bore cartridges, but in pigeon cases and 10-bores it will be noticed that no reduction is made in the case of the shot charge for the 33-grain powders. That Messrs. Eley attach great importance to these charges is shown by the fact that loads not in accordance with the above must be specified when ordering.

Another very interesting table is one giving the standard ballistics of the more important rifle cartridges. Although the table, as here produced, does not include certain cartridges, we should have liked to see present it has none the less a number of interesting figures:—

Description.	Bullet.	Muzzle.	
		Velocity.	Energy.
	Grains.	Feet per sec.	Ft. lbs.
Martini-Henry ·577/·450	480	1,350	1,985
No. 2 Musket ·500/·450	480	1,300	1,799
No. 1 Carbine ·500/·350	380	1,300	1,424
·44 Winchester	200	1,300	767
·301 Savage	186	1,975	1,610
·30/·30 Winchester	160	1,950	1,349
·25/·36 Winchester	117	1,950	1,071
·310 Cadet	125	1,250	433
·300 Extra Long	140	1,400	609
·300 Rook Rifle	80	1,100	215

The companion table, which relates to revolver and pistol cartridges, is also of considerable interest. In our reproduction of these two tables, we have given only the muzzle velocity and energy, so omitting these values for the 100 yards distance:—

Description.	Bullet.	Muzzle.	
		Velocity.	Energy.
	Grains.	Feet per sec.	Ft. lbs.
·455 Revolver	265	750	331
·450 Revolver	225	725	262
·380 Revolver	124	675	125
·320 Revolver	80	575	59
·38 Colt Automatic	128	1,100	344
·32 Colt Automatic	75	950	150

The same applies to the following table of standard ballistics relating to military small-bore cartridges:—

Description.	Bullet.	Pressure.	Muzzle.	
			Velocity.	Energy.
	Grains.	Tons per sq. in.	Ft. sec.	Ft. lbs.
·303 British	215	16·0	2,060	2,074
8 m/m Mannlicher (·315 in.)	240	14·0	2,030	2,199
7·9 m/m Mauser (·311 in.)	230	15·5	2,030	2,102
7·65 m/m Mauser (·301 in.)	219	15·5	2,000	1,943
7 m/m Mauser (·276 in.) ..	173	15·5	2,300	2,030
6·5 m/m (·256 in.) Krag-Jorgensen .. / Mannlicher .. .. / Mannlicher Schonauer	156	21·5	2,400	1,993

Among the sundries mentioned at the end of the book, we notice that a page is devoted to the two new proprietary articles, viz., Fluor Oil and Cunicide. The former is already well-known as a cleaning preparation for protecting the interior of all kinds of rifle barrels. The special advantage is that a single easily applied application seems to be quite effective for preserving even a rifle which has fired cordite cartridges. Cunicide, which appears on sale for the first time, is a fluid intended for filling into the barrel of a rifle in which the presence of cupro-nickel fouling is suspected. By its action the fouling is dissolved, and the barrel is restored to a clean condition.

We have received the following communication from Capt. T. G. Tulloch, who writes on behalf of the Chilworth Gunpowder Company:—"In your issue of June 1st, 1905, under heading 'Competition in the Explosives Trade,' there appears a statement to the effect that the Chilworth Gunpowder Company was not the first to manufacture cordite. We have always considered, however, that, omitting the Government Factory at Waltham Abbey, we were the first, as early in 1892 we began the erection of a cordite factory at Chilworth, and in December of that year began 'pressing' on a manufacturing scale in fulfilment of any order for many tons. The first government tenders for cordite were issued in June, 1894, for sizes 20 and 5; thus we were ready prepared, and had actually made large quantities of cordite considerably more than a year before the first government tenders were issued. We should be glad to learn if any other company can claim priority either of equipment or in manufacture."

CONTINENTAL DOINGS.

Electric Shot-Firing in Mines.—Since October, 1903, electric shot-firing has become general at the Drocourt Colliery in the Pas de Calais. Two exploders are used, the Siemens and Halske magneto-electric appliance, and the Meyer-Shamrock six-cell dry battery, both of which have given good results, while the latter has the advantage of being less cumbersome.

Belgian Mine Explosives.—The Belgian Mine Administration has issued circulars to the inspectors, with a list of the permitted safety explosives and the maximum charge for each. For instance, the charge of grisoutine II, which is composed of 44 nitroglycerine, 44 sulphate of soda, and 12 wood meal, is limited to 850 grammes (2 lbs.) ; and that of Belgian grisoutite, composed of 44 nitroglycerine, 44 sulphate of magnesia and 12 cellulose is 500 grammes (18·8 oz.).

Industrial Detonators.—In a paper to the Société de l' Industrie Minérale on the effects of various fulminants in industrial detonators, M. Schmerber observes that detonators with picric acid are at any rate as efficient as fulminate capsules, if not more so ; but the latter are to be preferred as regards regularity and inalterability. He particularly advises that the detonators be kept in a dry place, and be frequently subjected to test.

Arms at the Liége Exhibition.—Class 120 of the Liége International Exhibition, "Armament and Artillery," comprises the materials and processes of arsenals and gun factories, cannons and projectiles for the Army and Navy, small arms, ammunition and explosives; and Class 51, *Matérial de Chasse*, includes the materials and plant for the manufacture of sporting guns, special former lathes, and also machines for straightening, boring and drilling the barrels, trueing the bore, forming the butt, automatically producing the small iron or steel parts, trueing and finishing the hardened parts, cartridge-making machines, sporting guns, carbines, pistols, accessories, the reproduction of ancient arms, etc.

Large Cannon at the Liége Exhibition.—The Société Aciérie de la Marine et d' Homécourt, Saint-Chamond, France, shows a naval gun of 40 centimetres (15¾-in.) bore, and 12 metres (nearly 40 ft.) long, that can carry 25 kilometres (15½ miles), with an initial speed of 850 metres (2,789 ft.) per second. It is stated that, thanks to the rapidity with which the breech-piece can be worked, this cannon can fire three shots in a minute.

Favier Safety Explosives.—The consumption of these explosives in France has attained 1,000 tons per annum, and they are well represented at the Liége Exhibition, where a showcase contains the various qualities, also lead blocks which have served for comparative tests, viz., one of 12 cu.c's (0·732 cu. in.) internal capacity in its original state, another with this capacity enlarged to 728 cu.c's (44 cu. in.) by the explosion of 15 grammes (½ oz.) of dynamite, and a third enlarged to 978 cu.c's (59 cu. in.) by the explosion of the same quantity of Favier explosive. Photographs illustrate various tests carried out with this explosive by the Belgian Engineer Corps, as under :—

1. A red-hot iron rod, drawn through a cartridge, simply fuses the powder without showing a sign of explosion.

2. A case of cartridges allowed to fall on the floor from a height of 13 metres (42½ ft.) causes no explosion.

3. Some cartridges attached to a target and riddled with rifle balls are unaffected.

4. A cartridge placed on an anvil, and receiving the impact of a 280-kg. (617-lbs.) tup falling from a height of 4 metres (13 ft.), is neither detonated nor ignited.

Explosives at the International Mine Congress.—In the Mining Section of the Congress (25th June to 1st July), organized in connection with the Liége International Exhibition, and comprising 1,400 members, a report was submitted by M. V. Watteyne and M. S. Stassart on the tests carried out with explosives in the presence of firedamp at the Belgian Government Testing Station, Frameries; and Herr Bichel, manager of the Sprengstoff Aktien Gesellschaft Carbonit, Hamburg, put in a paper on the effects of explosive substances.

Large Blast at Antwerp.—For forming a canal to connect one of the Antwerp basins with the River Scheldt, it was necessary to demolish a sea wall 4 metres (13 ft.) thick, constituting a mass of masonry weighing 2,400 tons. The Engineer Corps bored several holes in the wall and charged each with 500 grammes (1·1 lb.) of tonite, fired simultaneously by an electric battery. The water remained agitated half an hour after the explosion, and hundreds of eels were thrown dead on the banks.

Larger Blast at Greifenstein.—In connection with the regulation of the Danube, it was required to remove a large mass of rock forming part of a quarry. After studying the combination calculated to give the greatest result with the slightest throwing forward of material, the engineers decided to form three underground chambers 40 metres (131 ft.) apart, each loaded with nearly 4 tons of dynamite. Cases containing 25 kilogrammes (½ cwt.) of the explosive were charged, 150 in each chamber, over which were placed four other cases, provided with both incandescent and spark detonators, the whole being covered with packets of dynamite. The explosion of the mine, fired by electricity, brought down altogether 280,000 cu. m. (366,246 cu. yds.) of rock, the cost being less than 1½d. per cubic yard.

Range of Projectiles.—The range of all small arms is maximum when the angle of elevation is between 30 and 32 deg., and approximately maximum when the angle is comprised between 20 and 45 deg., while it diminishes for angles of about 3 deg. The following table, from the *Bulletin de l'Armurerie*, gives the maximum range of round lead bullets fired with an initial velocity of 360 metres (1,181 ft.) per second :—

Diameter in millimetres.—													
2	3	4	5	6	8	10	12	14	16	17	18	20	
Range in metres—													
130	200	250	350	380	500	605	715	820	925	975	1025	1130	

All the small arms now used in warfare, with bores of 6 to 8 millimetres (0·236 to 0·315 in.) have a maximum range of 3,000 to 3,600 metres (3,281 to 3,937 yds.), while the French Army revolvers will carry to 1,000 metres (1093·6 yds.), and even 1,100 metres (1,203 yds.).

New French Cannons.—Two new cannons and a new mortar have been experimented with at Bourges and Puteaux (it is reported) in the presence of M. Bertaux, French Minister for War. In this connection M. Francis Laur asserts in the Paris *Echo des Mines* that, as regards artillery, France is now ahead of all other nations.

ROUND THE TRADE.

We understand that Cunicide will be on sale at Mr. Steward's tents in the Bazaar lines at Bisley.

The late Mr. C. W. Curtis left estate of the gross value of £174,882, of which £146,137 is net personalty.

Messrs. Debenham Storr & Sons announce a further sale of sporting effects, including guns and rifles of every description, to take place on the 19th inst.

The Cotton Powder Co., Ld., has declared dividends of 3½ per cent. on the preference shares, making 7 per cent. for the year, and 7 per cent. on the ordinary shares, making 10½ per cent. for the year.

Mr. Hugh Beckett, a director of the Birmingham Metal and Munitions Co., Ld., the Nobel-Dynamite Trust Co., Ld., and of Nobel's Explosives Co., Ld., who died on March 19 last, aged 81 years, left personal estate in the United Kingdom valued at £139,479.

It is reported that the Nobel Company recently dispatched a special representative to Tokio to superintend the erection of a large factory in Japan for the manufacture of war explosives. It is further stated that the factory will take two years to erect and equip, and it is stipulated that the Japanese Government is to have option of acquiring the new factory after ten years.

The Coventry Ordnance Works, Ld., is the name of a new company which has been registered with a capital of £1,000,000, divided into 500,000 preference, 250,000 "A" ordinary shares, and 250,000 "B" ordinary shares, to acquire from Cammell, Laird & Co., Ld., such part of the undertaking as is known as the Ordnance Works, Coventry. The first directors are Mr. J. M. Laird, Mr. H. R. Bevis, both of Birkenhead; Capt. T. J. Tresidder, C.M.G., and Mr. C. E. Ellis, the two latter of Sheffield.

The convention amongst manufacturers and handlers of high explosives appears to have broken down, and distributors are busy arranging new business on a revised scale of prices. The general impression appears to be that the past arrangement as to prices has been defeated by the agents for the smaller firms who appear to have departed from the agreed conditions of sale. For the time being, a policy of free trade is likely to bear very hardly upon some of the smaller fry. It is probable that after a year or so's experience of rock bottom trading it will again become practicable to re-establish a suitable range of current prices.

The prospectus of the Sir Hiram Maxim Electrical Co., Ld., shows that this company is very closely connected with the Peddie Small Arms Corporation, Ld., the latter company receiving the whole of the ordinary shares in part payment of the property acquired and for providing the management of the business. Out of a total capital of £50,000 the sum of £15,000 in preference shares has been offered for subscription. The general inference gained from reading the published particulars is that plant laid down by the Peddie Company will be utilised for the manufacture of electric lamps and other electrical appliances.

The report of Messrs. Greenwood and Batley, Ld., for the year ending March 31st, states that, after providing for interest on the debentures and expenses of management, and making due provision for doubtful debts, the accounts show a profit of £32,190, making, with £3,668 brought forward, a total of £35,859. Of this sum the directors have written off £7,500 for depreciation of plant, and have added £5,000 to the reserve fund, thereby increasing it to £35,000, and they recommend that dividends be declared at the rate of 7 per cent. per annum on the paid-up accumulative preference share capital, and of 6 per cent. per annum on the paid-up ordinary share capital, absorbing £17,333, and leaving a balance of £6,026 to be carried forward.

The report and balance sheet of the Kynoch Company was submitted to the annual general meeting held on the 29th ult. The accounts show a profit on the year of £92,424. This is practically the same profit as was shown in the previous accounts, though the capital has since then been increased by the issue of £300,000 in debentures. Of the above profit £9,240 is absorbed by debenture interest and expenses, £24,769 by a five-per-cent. distribution on the preference capital, and £37,500 by a ten-per-cent. dividend on the ordinary shares. These leave a surplus of £15,907 to be added to the carry forward of £40,000. The report states that on the whole the volume of business has increased. The balance sheet shows that the debenture issue has not been utilised by way of capital expenditure, the additions under this heading being only £7,343 against an average for the past ten years of £79,785. This money appears to have been utilised mainly in reducing by about £154,000 the item for sundry creditors, by an addition of about £48,000 to sundry debtors, and a further addition of about £83,500 to the item for cash and investments. The auditors' certificate contains a qualifying proviso to the effect that they regard an item of £18,136 under sundry debtors as not in their opinion a good debt.

At the official inquiry of the Cornwall Sea Fisheries Committee on the question of means of destroying dogfish, the use of explosives was suggested on two or three occasions, but little information was forthcoming in this respect. One speaker thought that explosives could not be legally used; another that they could be at a distance of three miles from the coast; a third did not mind whether dynamite or anything else was employed so long as the fish could be killed; and a further speaker suggested the mining of an area known to be infested with dogfish, and firing with electricity; while others thought the fish would only be stunned, or would sink after the explosion, and so be lost. Following are some extracts from a letter written by Mr. Ben Read, of Reforne, Dorset, concerning experiments in the blasting of fish, undertaken in June, 1877, before there were any penalties for using explosives near the coast:—"I should mention that it was twelve months before I could prevail upon a party of fishermen to take me off. Having at last succeeded, on June 3rd, at 7.30 a.m., we left the beach amidst the many good wishes of the fishermen, and especially of their wives, one of whom remarked that when the explosives did go off she hoped we would be blown to cinders. As we pulled off I prepared my charge a torpedo, the men in the boat deathly pale with fear. I could not persuade them that they were safe until after the shot, and then they saw for themselves. However, we pulled away to the south, and we could see the fish coming up in the bay—a fine shoal of them—and judging the distance and the rate they were going, placed a torpedo overboard, lighted it, and towed the charge across their course attached to the middle of a line pulled fairly taut between two boats. This first shot, of course, was an experiment. I had allowed too much fuse, and the consequence was the charge was not exploded until after the bulk of fish had passed over, so that it was only the tail-end of the shoal which was effected. When the charge exploded there came to the surface 42 bass, the largest fish I ever saw. We sent them all to the market, and received very good returns. The next shot was an improvement. We caught 62 bass, and again had good returns. Now comes the crowning shot of all. June 13th I left home at three in the morning, got down at 3.30, found the men waiting, and pulled off about two and a-half miles. After pulling out about one and a-half miles from the shore we could see the shoal very plainly. We laid on our oars, put the charge out, the heaviest I had used, and it exploded in the centre of the shoal, making a circle about 20 ft. in diameter, and that circle was as white as snow with fish, the grandest sight I ever witnessed. The air resounded with the shouts of applause from those who stood on the cliffs, and who, being elevated about 200 ft. above the level of the sea, had a fine view. There was a strong tide going at the time of the explosion, and we had plenty to do to pick up the booty, which was as follows:—609 bass, measuring from 1 ft. to 2 ft. 6 in. in length, twelve dozen whiting, three dozen congers, and two dozen sea bream."

THE DEVELOPMENT OF SMOKELESS RIFLE POWDERS.

By F. W. JONES.

A PAPER, entitled "Ammunition for Cannon," read by Capt. A. L. Ames, U.S.A. Ordnance Department, at the International Engineering Congress, St. Louis, October 1904, and reprinted in the *Journal of the United States Artillery*, describes the various stages in the development of U.S. Smokeless Powder. From our knowledge of the American progress as shown by the reports of the U.S. army and navy officials and this recent statement on the subject, we can say that the experience of the United States is a useful object lesson on smokeless powders.

When the first smokeless powders were made on a large scale by the various Powers they differed materially from one another, but latterly the difference is disappearing. In each case the style of explosive adopted was influenced by the facilities of manufacture. In those countries where manufacturers were assisted in every way by the Government, a commencement was made with powders gelatinized by ether-alcohol and generally without nitro-glycerine. In England the apathy of our Government in this matter left manufacturers in an unenviable position as regards the manufacture of this important product. The prohibitive price of sufficiently pure ether-alcohol restricted research to gunpowders gelatinized by acetone. Experiments under those conditions would naturally, at any rate in the earlier stages, drive manufacture into using powders of the nitro-glycerine type. Many believe that if the restrictions on the use of ether-alcohol had been less severe in England, a gunpowder containing as much nitro-glycerine as Mark I. Cordite would never have been adopted for service. The powder-makers, working with methylated spirit and methylated ether at comparative high prices had very inefficient and objectional solvents to deal with, as the report on the evidence before a recent commission on methylated spirits proves. Therefore one cannot wonder why powder gelatinized with this mixture never became general in this country.

This was not so in America. The Government Departments assisted manufacturers in every way, particularly by facilitating the supply of duty-free solvents and by carrying out long expensive experiments with their products. Consequently manufacture by a healthy competition combined with every facility for obtaining knowledge of the product soon settled down into a definite groove. There were advocates for powders of a wide range of composition some containing excessive percentage of nitro-glycerine like Cordite I; others running to the other extreme viz.: pure nitro-cellulose powder. On the other hand granulation of nearly every form was tried. To take an extreme case, large bore smokeless powders have been made and used in quantities with grains of seven perforations. It is not therefore difficult to appreciate that the experience gained forms a very useful chapter in the development of smokeless powders.

To go further into detail. The United States merely made experiments in small-arms in 1890 and the years following. These experiments were as far as the army was concerned reported on in detail by Col. Farley who had control of Frankfort Arsenal. Gunpowders containing 50 per cent. to 10 per cent. nitro-glycerine and both soluble and insoluble gun-cotton, with and without moderators, were thoroughly tested, as also were pure nitro-cellulose powders such as Troisdorf, Rifleite and B.N. In the end a powder, in composition closely following M.D. Cordite was used in large quantities for the ·300 army rifle. The navy, which still possessed a ·236 bore rifle, adopted as a result of experiments on a manufacturing scale a pure nitro-cellulose powder similar to Troisdorf. Later on when the navy took over the ·300 rifle, both kinds were used in this cartridge and apparently are still used at the present time.

Rifle powders present small difficulties in comparison with artillery powders. It was the experience in ammunition for cannon which demonstrated the weakness of the adopted explosives. In 1897 the army adopted for artillery a powder composed of 25 per cent. nitro-glycerine and 75 per cent. soluble nitro-cellulose of 12 per cent. nitrogen designated (N.N. 12·25), a product similar to M.D. Cordite. Its manufacture was discontinued in 1899 in consequence of damage to guns resulting from abnormal pressures. The cause was at first assigned to brittleness of the perforated grains, these grains break up during the early stages of combustion, increasing the burning surface and the evolution of gases. Later investigation suggested the more probable cause to the explosion having a low critical pressure. As a consequence of this experience the army adopted the pure nitro-cellulose powder which had for some time been in use in the navy.

The U.S. navy conducted researches similar to those of the army, but having a bias against nitro-glycerine, it selected a product almost identical with that so well known as pyro-collodion the Russian powder viz. a soluble nitro-cellulose of high nitration viz. 12·65 per cent. nitrogen and 99 per cent. solubility. All went well for several years until in 1902 irregularity was observed in powder which had been stored for several years. This led to a re-test of many of the older batches with the following result as stated by Capt. Ames.

"One conclusion reached from these re-tests was that all "lots when fired, have what may be called a critical pressure, "that is, a pressure above which the velocities and pressures "do not increase regularly with the charge, often showing for "charges corresponding to critical pressures no increase in "pressure from those previously obtained with smaller "charges, and for greater charges, irregular pressures and "sometimes dangerously high ones.

"Various causes have been assigned to account for the "existence of a critical pressure point and for the resulting "variations. Among these is the brittleness of the colloid, "and tests thus far made indicate almost to a certainty that "this is an important factor, due apparently to an increased "rate of burning as a function of the pressure and not to the "breaking of the grain.

"A second cause is the form of the grain now commonly "used by both services—the multi-perforated grain, about "2½ times its diameter in length. From its form it burns on "an increasing surface. The gases given off, therefore, are "an interesting function of the thickness of powder burned, "and as the thickness of powder burned is a function of the "pressure, the form may contribute, if other conditions are "favourable, to produce high pressures. Conditions would "be favourable if a powder had a high initial burning area for "the gun in which it was used and the projectile used had a "slightly larger or harder band offering an increased resistance, "as there would be a correspondingly rapid evolution of gases

"with corresponding pressures before the projectile could "take up sufficient velocity to make the space passed through "great enough to keep conditions normal in its rear.

"The form of the grain cannot be said to be the cause of "high pressures, but may contribute, if other conditions are "favourable for them.

"A second conclusion was that nitro-cellulose powder, as "they had been manufactured and delivered, tended to "increase slightly in ballistic force on storage.

"A slightly smaller charge would give the same velocity and "pressure as had been given previously by a larger charge. "A natural explanation of this was that the slight quickening "was due to some change in moisture and solvent from that "originally contained, but the investigations made did not "show this to be so in every case."

This last experience caused a reconsideration of the evidence regarding the old army powder, and many came to the conclusion that the abnormal pressures were due to bad manufacture combined with a questionable form of granulation. The U.S. are still in search of a perfect powder. We cannot pretend to instruct, but the history of smokeless gunpowders points very clearly to the general characteristics of the powder of the future. Let us consider these under the various heads:—

Composition.—This will be determined first by manufacture and secondly by erosion. Pure nitro-cellulose powders possess one insurmountable objection when made in grains of large dimensions, because it is impossible to get rid of the solvent during manufacture. The presence of nitro-glycerine and some other possible liquid ingredients lessen this difficulty. Therefore, the presence of about 25 per cent. nitro-glycerine is most likely to be finally adopted. Whether this will be combined with soluble or insoluble gun-cotton will depend on the solvent used. The amount and nature of the moderator influence manufacture, because many substances will assist the elimination of the solvent as well as help gelatinization, and are nevertheless quite as effective as moderators of combustion. In England, we fear this has never been fully realized, because vaseline the moderator used in Cordite has nothing to recommend it except perhaps its stability. Composition entirely controls the temperature of combustion and hence erosion to the extent that this depends on temperature. It cannot be said with certainty that erosion is proportionate to the temperature of combustion, but other things being equal, the coldest powder must have the advantage in this respect. There is a view prevalent that when a gunpowder contains nitro-glycerine it must have hot flame. This is not so, a compound containing as much as 25 per cent. nitro-glycerine can be combined with a moderator to produce a temperature of combustion even lower than that of a high nitration soluble gun-cotton.

Solvent.—This is determined to a great extent by the composition and nature of manufacture. The effect of solvents of equal power on the physical and chemical nature of the product has not been exhausted. It is a remarkable fact that so little has been done with gunpowders containing nitro-glycerine and soluble nitro-cellulose gelatinized by ether-alcohol, and therefore experience at present can tell us little or nothing as regards the effects on stability of such a solvent as acetone in comparison with ether-alcohol or a similar solvent. In this respect one has to remember that when the time factor extends over years, a very slight disposition of the solvent or its impurities to promote instability becomes evident. Consequently one may expect the solvent and its effect on stability to occupy the attention of the chemist of the future. Should ether-alcohol be found the better solvent from the point of view of stability this would determine gun-cotton as the best base for gunpowders of the future. Such a result is not at all improbable.

Granulation.—One might say that the U.S. experience has given the death-blow to fancy granulation. The advantages obtained from perforated grains are far outweighed by the dangers. Our own cord form of granulation may be taken merely as showing that a round hole is easier to drill than any other: certainly there is no other reason for its adoption, because it is the very worst form of granulation. A flat sheet or fairly wide tape has everything to recommend it. The burning area does not decrease too much as combustion proceeds, and there are no holes to cause irregularity. In fact, in this characteristic a simple form as is often the case is practically the best.

THE NEW GUIDE BOOK.

THE issue last month of a new Guide Book to the Explosives Act, 1875, must be welcomed by all who have occasion to consult that Act, and more especially by firms in the explosives trade with a large connection among retailers who, naturally, depend on those supplying them with explosives to keep them right in connection with all legal regulations affecting the trade. The preface mentions that 11,000 copies of the Guide Book prepared by the late Sir Vivian Majendie have been sold, which shows how necessary such a book was. But the enormous increase in the use of explosives and the consequent increase in number of magazines, stores and registered premises has made it of importance that all occupying licensed or registered premises have their obligations under the Act more explicitly stated than they were in his Guide Book.

It consisted of two parts, the first being an explanatory portion, and the second the Explosives Act, 1875, followed by Orders in Council and Orders of Secretary of State, to which in the later of the eleven editions, was added an index. When studying it one had constantly to turn from the Guide Book to the Act itself and to cross references in the Act, which made it a rather laborious task for anyone to arrive at the desired information, and an impossible task for many.

The new Guide Book extends to 411 pages, of which the first 230 pages are taken up by the Act, with foot notes, table of contents, and Orders in Council and Orders of Secretary of State; the 46 pages following contain very clear and methodically arranged summaries of the regulations affecting, principally, keepers of and dealers in explosives; six pages are occupied by the Act passed in 1883 to check the use of explosives for committing outrages, and an exhaustive index of 128 pages completes the book, which is almost twice the size of the previous Guide Book. The volume which Captain J. H. Thomson, H.M. Chief Inspector of Explosives, has so ably completed proves the thorough grasp which he has of the Act, and must have involved much study and hard work. The task of anyone referring to it for information is consequently very much easier than before, and the notes are so

numerous and so explanatory that no one should have any difficulty now.

Most of these notes are meant to assist the reader to understand different parts of the Act, some point out apparent conflicting regulations, while others give the meaning which H.M. Inspectors of Explosives attach to complicated or obscure clauses or sentences, and it is a striking testimony to the care taken in framing the Act that it has given rise to almost no litigation to settle doubtful points, although in force for almost 30 years. An amending Act, or a new Act might be of advantage in some respects, and the author of this Guide Book proves his ability to undertake such an important work, if called on to do so.

Captain Thomson's labours will be of the very greatest service to all who have at any time to refer to the Act, and it is to be hoped that he will be rewarded not only by their thanks but by a more careful observance of the Act on the part of those whom it affects, a higher standard in the conditions of magazines, stores and registered premises, and stricter attention to Rules relating to same, so making the duty of enforcing the very reasonable provisions of the Act lighter than it has been in the past.

The conditions regarding storage and transit of explosives have been considerably modified and facilities for transit of explosives very much enlarged during the last few years without, as far as the annual reports issued by H.M. Inspectors show, any increase of danger to the public or any increase in accidents. To their enlightened views these advantages are due, and it only requires the systematic and intelligent help of the local inspectors of explosives to render still safer the keeping and transit of what is now such a valuable and indispensable aid to labour in so many varied industries and public works.

LAST MONTH'S LECTURE.

A SLIGHT correction is necessary in certain of the figures published in our "Lecture to Young Gunmakers" of last month. The passages referred to involved the establishment of a relation between the turning of a Lyman backsight 30 inches distant from the foresight and the amount of correction so produced in the elevation, this being required in minutes of angle. The line of reasoning may best be set out in the following manner:—

One minute of angle equals one inch per 100 yards of range.

The 30-inch sight base equals the 120th part of the 100 yards range. Therefore the sights must be altered the 120th part of one inch, viz., ·008 in., to make one inch of correction. One turn of the Lyman sight produces a rise equal to the 20th part of an inch, viz., ·050. Therefore a correction of one minute of angle is produced by 8·50ths (·050 ÷ ·008) of a turn of the Lyman screw, which is approximately one-sixth of a turn.

The use of decimals makes this fraction of a turn appear to be an approximation, whereas it represents an absolute correction of one inch. The sixth of a turn makes a rise of the 120th part of an inch. This correction is multiplied 120 times at the target, and 120 times the 120th part of an inch is natural one inch. This value is approximately correct for any distance of sight base varying between the limits of 27 and 33 inches.

APPLICATIONS FOR PATENTS.

MAY 27—JUNE 17, 1905.

10,674. Small Arms. E. Delisse.
10,714. Targets. R. Ramsbottom and J. W. Hitchin.
10,901. Explosive. E. A. le Sueur.
10,941. Miniature Ammunition. J. Hassell.
11,002. Resizing Air-Gun Pellets. L. Jeffries.
11,016. Ordnance Recoil Brake. H. Hoppe.
11,081. Small-Arm Sights. A. Tunstall and W. F. Brant.
11,094. Clinometer for use in Gunnery. A. W. Ryland.
11,102. Rifle Sights. H. McKenzie and W. Tweadale.
11,278. Single-Trigger Mechanism. J. Robertson.
11,400.* Sporting Small-Arms. J. Robertson.
11,436.* Target. J. A. Hearson. (Agent for *Phönix Elektrotechnische G. m. b. H.*).
11,666.* Automatic Guns. A. V. P. M. Berthier. (Date of application in France, June 4, 1904).
11,672.* Magazines for Small-Arms. W. A. Sparks.
11,683. An Explosive Projectile. A. Vickers and G. T. Buckham.
11,695. Ordnance Sighting. A. F. Ball.
11,726. Telemeter. A. König.
11,741. Rifle Magazines. J. H. Matthews.
11,810. Shell Manufacture. F. Wigley and H. H. Mulliner.
11,816. Bore Holes for Blasting. R. Donaldson.
11,860.* Targets. A. J. Boult. (Agent for *Phönix Elekrotechnische G. m. b. H.*).
11,979. Ammunition Carrier. F. Wigley and H. H. Mulliner.
12,034. Ordnance Breech Mechanism. Sir W. G. Armstrong, Whitworth & Co., Ld., and A. G. Hadcock.
12,230. Sight Elevator. J. Gorst.
12,364. Small-Arm Barrel Cleaner. B. E. S. Stocker.
12,375. Ordnance Sights. M. L. Jannitti.
12,400. Fuses for Projectiles. F. Wigley.
12,401. Fuses for Projectiles. F. Wigley.
12,463. Fuse Setter. Sir H. W. W. Barlow and W. Charlesworth.
12,539.* Miniature Target. F. J. Choles.

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

JUNE 1—22, 1905.

COMPILED BY HENRY TARRANT.

4,774 (1904). **Automatic Firing of Rifles.** J. W. Esser, and G. W., and F. Barrett, London. Clockwork mechanism is adapted to operate a train of wheels which are arranged automatically to work the breech bolt backwards and forwards. Cartridges on a belt are fed into the breech and may be discharged at any speed up to about 70 shots a minute. Accepted May 26, 1905.

10,663 (1904). **Gun-Cotton Block Formation.** G. W. Bell, Hayle. A modification of the method of forming long blocks of gun-cotton in one piece for torpedo charges set out in Patent No. 17,415, is described in the present Specification. Instead of abstracting the water by a separate process the gun-cotton pulp is subjected to pressure whilst in the mould. A perforated wall allows the water to leave the mould. Accepted May 9, 1905.

11,344 (1904). **Bolt Action for Rifles.** O. Imray, London. (Agent for *Deutsche Waffen und Munitions-Fabriken, Berlin*). A lock mechanism for rifles of the military type constructed in order to obtain simplicity of form and number of parts. The mechanism is composed of seven limbs—the firing spring and its pin, the bolt, the locking piece, the safety catch, the bolt head and the extractor. The mechanism cannot be introduced into the breech casing without the breech bolt head is in position. Accepted May 17, 1905.

12,519 (1904). **Instructional Target Practice with Ordnance.** J. B. A. Légé. Apparatus adapted to allow of target practice at a moving target without actual firing, is described in this Patent. The main idea consists in attaching a pencil holder to the device so that the pencil shall make a continuous mark recording the exact movement during the sighting by

the gunner in his endeavour to follow the change in elevation. Heretofore only the position of the gun when the firing parts have been actuated has been recorded by the pencil. Accepted May 18, 1905.

13,896 (1904). **Target Apparatus.** W. W. G. Webb, Leamington; and J. Hall, Ashby-de-la-Zouch. A target made up of a number of sections is adapted to record the value or position of a hit and the frequency of hits during any interval of time. The target is made up of a number of sections, which recoil when struck and so close an electric circuit. The current operates a part at the firing point corresponding with the section struck. The sections are returned to position by springs. Accepted May 11, 1905.

14,236 (1904). **Range Finder.** G. M. Lawford, London. A range finder in which the short straight base of the ordinary telemeter is displaced by a limb forming an arc of a circle. This limb carries one fixed and one movable telescope, and it is claimed that even minute angles may be accurately measured by the displacement of the telescope when "finding" the object. The arc is graduated to give a direct reading. Accepted May 25, 1905.

15,044* (1904). **Safety Device for Projectile Fuses.** F. Wigley, and Capt. P. R. Embury, Coventry.

15,219 (1904). **Projectile Manufacture.** R. A. Hadfield, Sheffield. This patent deals with the production of a projectile capable of piercing plates of the Krupp cemented type without breaking up. A projectile composed of nickel chromium steel of the kind described in Patents Nos 27,753, 27,754, and 27,755 of 1897, but containing a lower percentage of carbon, is first slowly and carefully heated all over to a temperature of 820° C. to 890° C. in the case of a 6-inch projectile, and more or less according to the calibre of others. Whilst still at this high temperature the projectile is dipped point downward into oil to the depth to which it is required to harden it. The zone of hardness may thus be regulated but should not be made so long as to cause the wall of the chamber, if thin at the head, to crack on impact. Accepted May 11, 1905.

15,322A (1904). **Sectional Targets.** Capt. C. Chevallier, and E. Cadet, France. A target consisting of a fixed disc upon which is arranged a number of brackets. On these brackets movable segments are made to slide. The segments recoil when struck by a bullet, and this movement operates a pin which closes an electrical circuit. The position of the hit is in this way communicated to the firing point. The contact apparatus was set out in Patent No. 15,322, 1905. Accepted May 18, 1905.

16,127 (1904). **Ordnance Sighting Gear.** Sir W. G. Armstrong, Whitworth & Co., Ld., Newcastle-on-Tyne; and S. W. A. Noble, London. Sighting mechanism constructed in such a manner that the angle through which the sighting line has to be shifted to set it for any given range according to the scale, may be increased or decreased according as the muzzle velocity varies. The angle of the sighting line may be converted in reading of yards range on a scale to suit it to varying conditions which alter the velocity. Accepted May 25, 1905.

16,767 (1904). **Sighting Apparatus for Ordnance.** A. T. Dawson and G. T. Buckham, London. The graduations on the range dial are arranged in the opposite to the ordinary way. Large readings are indicated at short ranges and reduced readings at long ranges. The pointer is adjusted relatively to the indications of the range dial so that the readings may be varied to compensate inaccuracy due to falling off of muzzle velocity. Accepted June 1, 1905.

16,922 (1904). **Blank Ammunition.** The King's Norton Metal Co., Ld.; T. A. Bayliss, London; and H. M. Smith, Abbey Wood. In Patent No. 14,208, 1904 (fully dealt with in the April, 1905, issue of *Arms and Explosives*), a blank small-arm cartridge was described. The present patent deals with a method of providing the body of such a cartridge with distinctive coloured bands to afford further visual indication of its nature. The bands are arranged in cannelures to prevent defacement. Accepted May 11, 1905.

17,153 (1904). **Projectile Construction.** P. M. Justice, London. (Agent for *The Bethlehem Steel Co., U.S.A.*). In order to prevent the tendency of the body of an armour piercing projectile upon impact to "barrel out" more weight is put into the base without detracting from the capacity of the cavity for explosive material. A driving band is located at the base away from the part of the wall which is liable to upset. The wall is left of maximum thickness and strength. Accepted May 25, 1905.

17,154 (1904). **Sights Mounts for Ordnance.** P. M. Justice, London (Agent for *The Bethlehem Steel Co., U.S.A.*). In order to obtain the vertical adjustment of ordnance sights with a minimum movement, the axis for vertical movement is arranged close to the trunnion of the gun. The width of the sight opening in the shield is decreased by mounting the vertical axis of the sighting device close to the shield; and the sights on opposite sides of the gun are connected so that they move absolutely together. Accepted May 25, 1905.

18,097 (1904). **Controlling the Flight of Shot.** G. C. Dymond, Liverpool (Agent for *C. La Dow, U.S.A.*). A method of concentrating and scattering a charge of shot consisting in causing a part of the gases of explosion to pass through the wads and so either envelope or pass through the charge of shot as it leaves the gun. The direction of the holes in the wads determine whether the gas shall be directed to the centre of the charge to scatter it, or to the outside of the charge to envelope and so concentrate it. Accepted May 18, 1905.

28,808* (1904). **Manufacture and Use of Dinitroglycerine.** The Centralstelle für Weisenchaftlich Technische Untersuchungen, Germany.

362 (1905). **Ordnance Sighting Apparatus.** C. D. Abel, London (Agent for *Rheinische Metallwaaren-und-Mfg., Germany*). In Patent No. 22,975, 1904, a construction of sighting apparatus for ordnance, having an independent sighting line, was described. By the present invention the sighting apparatus is so arranged that the necessary corrections due to the inclination of the wheel base can be effected without varying the range or without the use of correcting tables. Accepted May 11, 1905.

6,155 (1905). **Disappearing Gun Carriages.** A. H. Emery, U.S.A. An improved gun carriage of the type in which the gun rests on a link system, by which it is raised to the firing position, and a link system is used to control the angle of elevation is described in this Patent. The specification is lengthy and fully illustrated, and many parts of the description of carriage are dealt with, the counterbalancing and recoil press devices receiving foremost attention. Accepted June 1, 1905.

9,663 (1905). **Miniature Rifle Ranges.** Maj.-Gen. C. E. Luard, Sevenoaks. Apparatus, consisting principally of a pair of guide rails, designed to steady targets for miniature rifle ranges of the type described in Patents Nos. 704, 1901, and 25,964, 1902. The rails extend across the width of the range and serve to hold the targets from being moved appreciably out of their own plane whilst in the line of fire, and to prevent any lateral oscillatory motion whatsoever. Accepted June 1, 1905.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

MANUFACTURE AND USE OF DINITROGLYCERINE.

28,808 (1904). The Centralstelle für Weisenchaftlich—Technische Untersuchungen, Germany. In order to obtain high yield of dinitroglycerine, great care must be exercised in determining the composition of the acid mixture, and the patentee continues, it is advisable to determine the proportion between the same and the quantity of glycerine used in such a manner that when the two are brought together very little oil is separated out. The formation of an unsoluble oil (trinitroglycerine) must as far as possible be avoided if the intention is to promote the formation of dinitroglycerine. The manner of proceeding in the manufacture of the last-named compound is set out as follows. One hundred grammes of glycerine are with constant stirring allowed to flow at 18 deg. to 20 deg. C. into 500 grammes of an acid mixture composed of 10 per cent. water, 22·5 per cent. nitric acid, and 67·5 sulphuric acid. No oily separation takes place, or at most only to a slight degree,

and such small quantities as are separated out consist exclusively of trinitroglycerine. The oil is removed, and the acid mixture in which all the dinitroglycerine is contained is diluted with water.

To every one part by volume of this acid, preferably ten volumes of water are added, as when it is thus diluted the action of the acid on the extracting agent is avoided. The dinitroglycerine with the extraction agent (ether or the like) is first neutralized and leaves behind it on distillation an oily liquid which generally still contains a trace of trinitroglycerine.

In order further to purify the product it is dissolved in water, and any trinitroglycerine present remains undissolved. The aqueous solution is thus extracted a second time, the extracting substance distilled off, and the dinitroglycerine remaining behind is dried.

The acid solution of dinitroglycerine may also be neutralized, any sulphates formed are pressed out, and the neutral liquid obtained extracted or distilled in vacuum. By this method it is easy to obtain more than 60 per cent. of the theoretical yield. The dinitroglycerine obtained is a colorless or slightly yellow oil of the specific gravity of 1·47 at 15 deg. C. It congeals to a glassy mass only at a temperature of less than 30 deg. C. and boils at a constant pressure of 15 mm. of mercury at 146 deg. C. It is easily soluble in ether, alcohol or acetone. In water at 15 deg. C. it dissolves in the proportions of 1 to 20, and is still more soluble in dilute acids about 1 in 5. It has a burning taste, and has on the nerves of the head a poisonous effect similar to that of trinitroglycerine. In the Tranzel lead block a mixture of 7·5 grammes of dinitroglycerine and 2 5 grammes kieselguhr produces a bulging of 290 ccm. (Ten grammes of 75 per cent. dynamite produce 345 ccm.). It is considerably less sensitive to shock, it is claimed, than trinitroglycerine.

Dinitroglycerine can be esterified for instance according to the usual methods of the esterification of alcohols. It reacts with acetylchloride, benzoylchloride and the like, and forms then the corresponding acetyl and benzoyl esters. These esters produce considerable gelatinising power on nitrated cellulose, nitrated starch, nitroglycerine, nitrohydro-carbons, etc. They are not hygroscopic; they are easily soluble in ether alcohol and acetone; and are insoluble in water. They may, therefore, replace nitroglycerine in the manufacture of powder. The low freezing temperature of dinitroglycerine makes it suitable as an addition in order to prevent nitroglycerine explosives from freezing, and generally, it is claimed, both dinitroglycerine and its esters may be used in the manufacture of explosives either by themselves or as an addition to other explosive compounds Accepted May 11, 1905.

SAFETY DEVICE FOR PROJECTILE FUSES.

15,044 (1904). F. Wigley and Capt. P. R. Embury, Coventry. In this specification is described a safety device for combined time and percussion projectile fuses. A safety ring is provided, which, in the normal position, renders both the time and percussion devices inoperative, but when partly turned, frees the percussion device, and when again turned frees also the time mechanism.

The safety is illustrated in the drawings reproduced on this page. In the body *a* (Fig. 2) of the fuse is arranged the time composition *b* communicating through the passage *c* with the chamber *d*. In this chamber the time pellet *e* is situated. The pellet is supported by the shearing wire *f*, and also by the pin *g*. The percussion pellet *h* is normally prevented from moving forward by the ball *i*, held in position by the plug *j*, which is supported by the shearing wire *k* and also by the pin *l*.

The two pins *g* and *l* are provided with light springs as is shown in Fig. 5, which tend to force the pins outwards to free the pellet *e* and the plug *j*. The pins are, however, nominally held by the safety ring *n*, which is shown in the illustrations in the safe position, a part of it projecting into the passage *c*. When the fuse is to be used, and it is desired to set it for percussion firing only, the safety ring *n* is turned until the spring catch *o* on its exterior reaches the slot *p*. This movement brings the recess *q* in the ring (Fig. 3) to a position opposite to the pin *l*, which is allowed to move to free the plug *j*. When the gun is fired, the wire *k* is sheared and the plug moves to the back of the chamber containing the percussion pellet. The ball *i* is then forced away from the nose of the pellet by centrifugal force, and so the pellet is entirely freed.

Should the desire exist to set the fuse for explosion after a certain period, as well as upon impact, the safety ring is turned until the catch *o* enters another slot *r* (Fig. 1). A recess *s*, in the upper part

Fig. 2

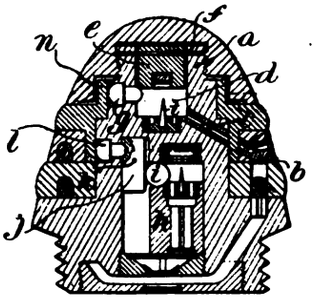


Fig. 5

Fig. 1

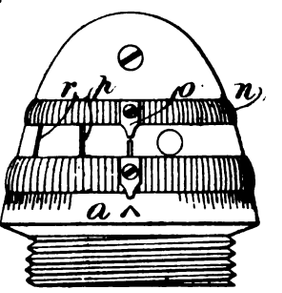


Fig. 3

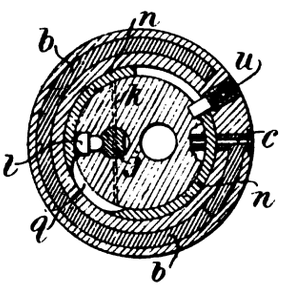
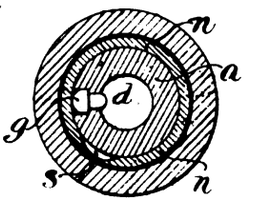


Fig. 4



of the ring, is by this movement brought opposite the ring *g* which is allowed to move outwards, and thus to free the time pellet *e*. When the gun is fired the wire *f* is sheared, and the pellet coming back against the needle *t* fires the composition. The recess *q* is made so long that the further movement does not again lock the pin *l*. The stop *u* is arranged to limit the movement of the ring. Accepted May 11, 1905.

TRADE MARKS.

ADVERTISED. JUNE 7—28, 1905.

272,516. The word PRIMAX. To apply to explosive substances. Kynoch Ld., Birmingham. May 5, 1905

272,934. } A device composed of a feather and the words FEATHER
272,935. } WEIGHT. To apply both to arms and ammunition, and to explosive substances. Curtis's & Harvey, Ld., London. May 20, 1905.

REGISTERED, MAY 18—JUNE 21, 1905.

269,591. C. G. Bonehill.

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CONTENTS.

CURRENT TOPICS.

A Good Second.—One of the new features which attracted a good deal of attention at Bisley was the process of freeing rifle barrels from metallic fouling by chemicals. The King's Norton Metal Company laid themselves out to do this at sixpence a time, and were busy throughout the meeting. It is now over twelve months since Capt. Hardcastle first insisted that good shooting can only be maintained in a rifle firing metal-covered bullets by dissolving out the metallic fouling. This at all times accumulates more or less, and may exist in objectionable amounts even when its presence is not obvious to the eye. His results with micro-photographs of fouled barrels were duly published in the *Proceedings of the Royal Artillery Institution*. Capt. Hardcastle, with the assistance of Dr. Hodgkinson, adopted a solvent for metallic fouling which he termed Cunicide, a name derived from the chemical symbols: copper (cu), nickel (ni) and cide (kill). The King's Norton Company have christened their solvent "K.N.S.," these being the initial letters of King's Norton Solvent, or copper nickel solvent as one pleases. Cunicide is blue in colour due to the active copper salt, but "K.N.S." is water white, and as the copper of the fouling enters into solution becomes blue, showing its action and at the same time when the barrel is quite free from copper. There are several chemical mixtures which will dissolve copper fouling without any action on the iron of the barrel, and some of them water white. The merits of these mixtures will be settled by practice, but the King's Norton Company have done useful service and deserve every credit for bringing the question so prominently to the front. We must not, however, overlook the fact that Capt. Hardcastle made this subject his own, and must be accorded all the laurels unless the above Company can show that they have discovered a substance, not previously known to chemistry, which dissolves better than any of the well-known mixtures.

Cadet Rifle Developments.—There are sundry evidences of a very important change of attitude in connection with the class of rifle that may be used by miniature clubs. Hitherto the National Rifle Association has discountenanced weapons which are not of strictly service type, admitting only those which are fitted with Morris tubes, adapters or other devices for firing reduced charges. Clubs have not been absolutely forbidden to use miniature weapons, but these arms have been ostracized in many ways. The more recent tendency is to adopt as the equivalent for the service rifle, the same weapon fitted with a ·22-bore barrel and modified to act with rim-fire cartridges which are so popular because of their cheapness and accuracy. Even Enfield is reported to be working on such a rifle, this in spite of the fact that we have in our possession a letter less than a year old in which, after careful enquiry amongst Enfield experts by a prominent official, it was reported to us that there was no likelihood of such a weapon being undertaken. The moment this type of rifle is admitted on the same level as the service weapon fitted with an adapter, we shall find that shooting practice will derive great encouragement from the recognition of a type of ammunition far cheaper than that suited to any known system of adapter. So soon as the ·22 calibre Lee-Enfield rifle becomes established, the way is clear for the development of a cadet pattern of single-shot rifle having military-shaped sights placed approximately at the distances encountered in a military weapon. Such a rifle

may also be of approximately military weight and fitted with approximately the same shape of stock. It is thus clear that by an easy series of stages we pass from the adapted military type of rifle to the true cadet weapon giving practice of first-class importance at a low cost and in a mechanism more convenient than the bolt for single-shot shooting. We thus abandon the crazy notion that to learn shooting one must of necessity operate a turn-bolt mechanism.

Orthoptic Sights.—It will be seen from the above that the aperture sight is not likely to occupy a prominent position in the programme of the future. The Exeter meeting showed that first-class results could be obtained with open sights under the exceedingly difficult conditions of an indoor range. It has been recognised that this arose from the fact that open sights are placed on a service rifle in a position where they can be seen by the shooter, whereas the unpopularity of the same class of sight on a short-length rifle arises from optical difficulties which cannot be overcome. No one appreciates more fully than we do ourselves the advantage of an orthoptic sight. It clears the foresight and produces a general sharpness of definition which enables the shooter to concentrate his attention on hitting the bull. The merit of the aperture sight is, however, mainly confined to the open air range. The ordinary six-inch square of cardboard produces an insufficient background to show up an orthoptic sight on an indoor range. Moreover, the illumination, which is generally of an inferior quantity, makes it undesirable to cut down the amount of light entering into the eye. We accordingly find that the ordinary Lyman sight is well-nigh invisible indoors, and that it certainly fails to appeal to the young beginner as a tangible means of directing the aim. With well-placed open sights on the other hand the shooter can see for himself what is happening on the rifle and on the target. Hence he soon accustoms himself to the problem of aligning his sights in spite of the blur. The extensive use of aperture sights on miniature rifles has largely arisen from the extreme shortness of these weapons, which prevents open sights from being placed at a favourable distance from the eye and from one another; also by reason of the fact that the Lyman sight can be adjusted to a greater degree of nicety than any open sight with which we are acquainted. If we regard the matter from a proper standpoint we shall surely see that the manufacturer will be well advised in adopting a longer barrel than hitherto and in applying the cost of the Lyman sight to the manufacture of a simple form of open sight which will give the necessary fine graduations of adjustment.

The Air-Gun Analogy.—If we seek for an explanation of the success of the new type of air-gun with the piston and cylinder mechanism in front of the trigger-guard, we shall find that it probably arises from the fact that the sights have been moved a suitable distance away from the eye. There has accordingly been no attempt in Birmingham to introduce the Lyman sight for air-gun practice. The target ordinarily used is of ample dimensions to form a background for open sights situated at a favourable distance from the eye. An aperture sight on the other hand would probably project a halo on the retina which would have an apparent diameter several times larger than that of the target. The marvellous accuracy of the shooting which these weapons produce is as much a testimonial to the general improvements of mechanism which have been introduced, as to the suitability of the sighting. Amongst the former we must single out for special mention the success which has attended the rifling of air-gun barrels. At first no great improvement in result was noticed, chiefly because of the futility of rifling a barrel for a bullet already several sizes smaller than the bore. Experience has all along shown that the resistance offered to the passage of the pellet in its course up the barrel must be kept well within the margin of strength of the spring, and this difficulty has been provided for in the case of the rifled air-gun in a variety of ways all working on the same general idea. The bullet is, as a rule, not made of true cylindrical form, but is pinched in at the middle so as to reduce to the smallest possible extent the length taking the rifling. The best air-gun bullet at present on the market is the one manufactured at Witton. It possesses the exceptional merit of an exceedingly long bearing surface with a very small amount of length actually taking the rifling. Another improvement on sound lines is the new Lincoln Jeffries pattern of fixed barrel. This has got rid of the disadvantages of what must at best be but an unreliable fastening, the tendency of which is to allow a serious escape of air. Unless the sights had been capable of keeping pace with these improvements of mechanism, they would have been discarded long ago.

The Explosives Report.—Our connection with the explosives industry covers a period of a little over twelve years, whereas H.M. Inspectors of Explosives have just issued their twenty-ninth annual report. Whether every one of the twenty-nine reports has contained a certain recommendation which is still ignored we cannot say, but during our own term of recollection no single occasion has been missed of pointing out that the administration of the Explosives Act by the local authorities has been, and is likely to remain, a failure. One must assume that the strife of political life prevents the Home Secretary, and for that matter the permanent officials as well, from paying proper attention to the administrative demands of their various offices. They may have a vague general idea that the explosives department is run on singularly efficient lines, gives no trouble and is of great use for investigating anything from the composition of an explosive cigar to the calibre and characteristics of the bullets fired into the North Sea fishing fleet by the Russian Armada. Probably it has never occurred to these officials to take serious notice of the oft reiterated appeals to centralise all that appertains to the regulation of the explosives industry. "We have in various reports stated our opinion that decentralisation is not desirable in the administration of so highly technical an Act." It is in these polite terms that H.M. Principal Secretary of State is told, possibly for the twenty-ninth time, that those provisions of the Explosive Act, which are supposed to be administered by the local authority, are not seriously regarded. The detailed comments appearing further on in the report show that many local authorities trouble themselves but little about this portion of their duties. Our reason for demanding, on behalf of the trade, a better system of inspection than exists under present methods of administration, is that an accident of serious dimensions might at any time arise and start an agitation for the withdrawal or curtailment of the existing storage facilities which are so necessary to an important section of commerce.

OCCULTISM IN CARTRIDGE LOADING.

The writer of the present article has before now been accused of having done more to ruin the cartridge trade of the gunmaker than any other individual or series of causes which have worked in the same direction. This allegation is mainly based upon our desire to encourage the standardisation of the powder, the cartridge and the gun, with the idea of increasing the effectiveness of the combination. The injury which this is supposed to have done is to inculcate into the mind of the shooter the idea that perfection of method in cartridge loading is better attained in the factory than in the gunmaker's loading shop. There can be no doubt as to the great care with which many of our leading firms have studied the commercial problems of their business. We may accordingly regard a circular letter which has been forwarded to this office by a firm, which can fairly be described, as falling within the above category, as a carefully considered statement of policy.

Sir,—I am sending enclosed my new season's catalogue of shotgun cartridges, and shall be obliged if you will kindly peruse same. The prices shown are as low as is consistent with best material and careful loading, and, while you will doubtless be quoted lower prices for "machine" and "factory loaded" ammunition, you would, I can assure you, be amply compensated for the little extra expenditure by the increased pleasure derived from a "clean kill."

By continuous and careful experiment I am enabled to select those materials and loads which enable me to supply a cartridge giving as nearly as possible absolute uniformity in pattern, and I can confidently assert that my hand-loaded ammunition gives greater distribution and regularity from shot to shot, with reduced recoil and less strain on the gun, than any "factory-loaded" cartridge ever produced, while at the same time maintaining the standard velocity.

Cheap factory-loaded ammunition is merely a straining after uniformity, but, in my opinion, the uniformity generally attained is in inferiority only. Every gun possesses an individuality in its shooting, hence variation must be made in the loading of the cartridge to suit its particular peculiarity if really satisfactory shooting is to be obtained. My hand-loaded cartridges exactly fill this essential, and a trial order will quickly prove their superiority.

We quite agree with the principle of stating that any prices quoted are as low as are consistent with the use of best components and careful workmanship. But we differ at once when it is implied that machine or factory-loaded ammunition is less likely to possess clean killing properties. To start with, we have never yet been able to understand the distinction which is supposed to exist between hand and machine loading. The more efficient the methods of loading the more complete and the more refined is the machinery used for the purpose, and we cannot believe the firm we are quoting is any more capable than other people of dispensing with the aid of machinery; and if it uses machinery in any form whatsoever we cannot see how it can be justified in casting aspersions upon the efficiency of such methods, nor why one place should claim the monopoly of turning out clean-killing cartridges.

We have no objection to any cartridge loader stating for his customers' information that by careful experiment he has been able to arrive at a suitable specification. "As nearly as possible absolute uniformity in pattern" is a meaningless phrase, in so far that the meaning is controlled by a qualification, which is not defined. When we come to a combination of good pattern, reduced recoil, less strain on the gun and standard velocity, we must confess to the feeling that these terms savour rather of rhetoric than scientific argument. We must, however, point out that one standard at least, viz., velocity, is recognised as essential. How a cartridge can give reduced recoil with a given charge and a standard velocity we do not know. Then again, strain on the gun is presumably a function of the pressure produced, and it is now recognised by all powder makers that this pressure must reach a certain level to ensure efficient results, and we do not see how the strain on the gun can be lessened concurrently with maintaining a proper level of pressure. To our way of thinking the proper method of dealing with this aspect of cartridge loading is to make a gun strong enough to stand the stress created by a properly loaded cartridge with a suitable extra margin beyond the working load.

We disagree entirely with the definition of cheap factory loading. Given certain components carefully selected with due regard to the price of the finished article we can find no reproach in the assumption that factory loading endeavours to reproduce the standardised sample as closely as possible. Such a batch of cartridges may be uniform only in their inferiority, since obviously each repetition of the first sample contains the same inferior materials. Sight is, however, lost of the fact that second-grade materials perfectly made up on the most approved system of loading may produce a more satisfactory cartridge than the best materials badly put together. Uniformity of powder charge, of shot, and uniformity in the seating of the wads and in the formation of the turnover are hardly fairly described as uniformity in inferiority only. To us they appear to represent uniformity of a praiseworthy character. The trouble of the entire situation is not the badness of the cheap factory-loaded cartridge so much as its excellence. It represents, in fact, too much value for money. A standardised powder carefully loaded into a nitro case with ordinary card wadding and second quality felt gives such remarkably fine results that it is difficult to adopt a sound line of argument in condemning it. This may possibly explain the unsound reasoning and faulty logic which are used in condemnation of the factory cartridge.

It may be true that every gun possesses an individuality in its shootiug which necessitates special cartridge loading, but we cannot help thinking that this is a double-edged argument in that it suggests that after all these years the gunmaker confesses that he cannot make a gun to shoot an ordinary cartridge. Assuming the correctness of the above quoted assertion we state from our own knowledge of such matters that the fair cost of a series of researches to determine the best load for a gun would fall little short of £5, and that there are not more than six or eight establishments in the country capable of carrying out the test. Pattern tests alone are not sufficient to justify a departure from a recognised load, except perhaps in the case of clay bird shooting, where penetration occupies a position of secondary importance. We cannot see how the hand-loaded cartridge can better suit a peculiarly bored gun than one taken from factory stock. A trial order might once in a way prove the assertion; but it is not likely that hand-loaded cartridges will succeed any better than factory output in the absence of special researches to determine the theoretically perfect load. So long as the shooter can make up his mind as to the size and quantity of shot that best suits his purpose we cannot find any genuine grounds for him to ask for variations from standard practice in any other direction.

ANNUAL REPORT OF H.M. INSPECTORS OF EXPLOSIVES.

THE twenty-ninth annual report of H.M. Inspectors of Explosives contains the usual evidences of careful administration of a very important Act of Parliament. Dr. Dupré makes the following announcement in connection with the research work conducted by him during the past year :—

"Some further experiments were made with the test shortly described in last year's report, under the name of the Vapour Tension Test. A number of samples of cordite of various ages, which had been returned from various stations abroad, on account of the low heat tests given, were submitted to the test, which in all cases they passed satisfactorily, all the curves showing the rates of decomposition being practically identical with the curve given by a cordite of recent manufacture and high heat test. If further experience should confirm these results, this test will have proved itself capable of deciding whether a low heat test shown by cordite indicates danger or not, and so far is the only test among those proposed which is apparently, like the heat test, directly applicable to nitroglycerine explosives.

The next test to be examined was that proposed by Messrs. Bergmann and Junk. This is a test identical in principle with that brought to our notice by Nobel's Company, but differs from it in the apparatus used. It depends, like that test, on the measurement of the nitrogen evolved in the form of various oxides of nitrogen, when the guncotton is kept at a temperature of 132° C. for two hours. It was found, in the first place, that duplicate experiments with the same sample of guncotton gave, as a rule, very concordant results, but that the test was influenced to a considerable degree by variation in the percentage of moisture in the samples tested. This was more especially found to be the case when the sample was not perfectly purified, and might thus easily lead to mistaken decisions with regard to the rejection or approval of samples near the limit of purity, unless certain limits of moisture are very rigidly observed.

The test is scarcely influenced at all by the presence of perchloride of mercury, which, as is well known, renders our heat test inapplicable, but like this latter test it is greatly influenced by the presence of urea. The test is also greatly affected by the condition of the guncotton tested, *i.e.*, whether gelatinized or simply pulped, the former giving far lower results than the latter. The test in its present form is not applicable to nitroglycerine preparations or to such as contain nitrates, and does not distinguish so sharply as the heat test between the various stages of washing of guncotton. Lastly, in spite of all care taken, tests made on the same sample gave occasionally widely different results, due perhaps to the fact that the products of decomposition are left in contact with the sample throughout the test, whereby very small differences in the rate of decomposition at the beginning of the experiment would be greatly aggravated at the end.

The next test examined was that which consists in the determination of the temperature of the exploding point. This test, when carried out under precisely identical conditions, gives fairly concordant results, but the differences between the temperatures of the exploding points of samples differing widely in purity, are too small to allow of the discrimination by means of this test between samples differing but slightly. The test also is greatly influenced by many conditions, such as temperature of bath at commencement of experiment, rate of rise of temperature, size of tube used, quantity of explosive taken, etc., etc., and could not therefore be used as a substitute for the heat test, though it might prove useful when used in conjunction with it.

Lastly, many experiments have been made to determine the various conditions influencing the heat test, and to fix as far as possible the precise conditions under which it should be carried out. These experiments are not as yet complete, but enough has been done to confirm our previous conviction that for the purposes of our Department, which deals almost exclusively with explosives of recent manufacture, the heat test, when carefully carried out, is well qualified to decide whether these explosives have or have not been sufficiently purified. Moreover, the heat test is so far the only test advanced which is at all capable of dealing in a satisfactory manner with the great variety of explosives contained in our Authorized List.

The following particulars are extracted from the list of explosives imported during the year under review :—

Ammonal.—Ammonal Explosives, Ld.	325 lbs.
Blasting Gelatine.—	
Alliance Explosives Co., Ld.	87,500 lbs.
W. Marden & Co.	253,750 lbs.
National Explosives Co., Ld.	39,700 lbs.
J. Russell	2,850 lbs.
J. R. Watson & Co.	6,000 lbs.
Carbonite.—	
Carbonite Syn., Ld.	130,400 lbs.
Fr. Richter & Co.	132,000 lbs.
Celtite.—A. J. Brown & Co.	40,000 lbs.
Chilworth Sporting Powder.—The Chilworth Co...	10,010 lbs.
Cooppal Powder.—J. R. Watson & Co.	2,500 lbs.
Detonators.—	
Alliance Explosives Co.	1,680,000
W. N. Blakeley	155,000
A. J. Brown & Co.	300,000
W. Marden & Co.	1,130,000
C. G. Mueller	5,524,912
S. Salisbury	964,000
J. R. Watson & Co.	4,426,000
Fr. Richter & Co.	1,051,000
Dynamite.—	
Alliance Explosives Co., Ld.	240,000 lbs.
W. Marden & Co.	45,000 lbs.
J. R. Watson & Co.	5,000 lbs.
Electric Detonators.—J. R. Watson & Co... ..	50,000
Electric Fuses.—	
Bickford, Smith & Co.	5,000
C. G. Mueller	1,012,200
Fuse Heads.—Nobel Explosives Co., Ld.	5,050,000
Gelatine Dynamite or Gelignite.—	
Alliance Explosives Co., Ld.	362,000 lbs.
W. N. Blakeley	16,000 lbs.
A. J. Brown & Co.	252,500 lbs.
W. Marden & Co.	472,500 lbs.
National Explosives Co., Ld.	7,700 lbs.
J. Russell	6,000 lbs.
J. R. Watson & Co.	3,000 lbs.
Matagnite Gelatine:—J. R. Watson & Co.	17,000 lbs.
Normal Powder, No. 2.—Normal Powder Co. ..	24,000 lbs.
Permitite.—W. N. Blakeley	20,000 lbs.
Picric Acid,—E. J. Coste	252,256 lbs.
Russell Gelignite.—J. Russell	98,700 lbs.

Considerations of space prevent us for the moment from devoting adequate attention to the illuminating report by Captain Desborough, in which he passes under review the apparent results after five years' experience of the Act for regulating the use of explosives in fiery mines. It is not difficult to see from his ably drawn conclusions that definite benefits have arisen from this piece of legislation.

THE BISLEY MEETING.

THIS year's Bisley meeting was marked by the exceedngly favourable conditions of weather which have been so welcome a feature during recent years. Speaking at a time when all the excitement of the contests has gone by, it is somewhat difficult to particularise special details for consideration. The past Bisley has certainly been remarkable for an unusual departure from the customary War Office practice of maintaining silence about new developments pending their delivery to the soldier for use. M.D. cordite has been thoroughly tried in the match rifle, and so far as accuracy is concerned it has acquitted itself at least as satisfactorily as the older pattern of cordite. It must, however, be recognised that its satisfactory behaviour has arisen in combination with the most painstaking loading and a range of ballistics which are above what may be regarded as possible service limits, either now or in the immediate future.

The ·303 barrel has certainly maintained its reputation for good shooting, but the 6½mm. Mannlicher has been used with well-nigh equal success by a number of competitors. Some of these actually abandoned the larger calibre in favour of the ·256, and this immediately proceeding the Bisley fortnight. Such a step may be regarded as evidence that the ·303 barrel is still open to the disadvantage of landing the user in difficulties upon the advent of very hot weather. This may be partly accounted for by the peculiar features of many of the ·303 systems of boring which are used for match rifle shooting purposes. Whether they would arise to a similar extent with the service system of boring and chambering has not to our knowledge been satisfactorily settled. That metallic fouling is not the sole cause of deteriorated shooting properties has been shown in several instances by the discarding of barrels which have fired a comparatively small number of rounds, and whose fate has been sealed after finding that the removal of the metallic fouling by chemical treatment has failed to provide a remedy. One must not of course lose one's sense of proportion in discussing matters of this kind, since it must always be borne in mind that military usefulness is not necessarily determined by the ability of a rifle barrel to respond to the skill of a shooter capable of placing a succession of shots into a 36-inch bull at 1,000 yards. If it is possible to combine this refined element of accuracy with good qualities of a purely military character, so much the better. Meanwhile it requires a clear head and a keen intelligence to read aright the experiences of the Bisley marksman.

The use of telescopic sights on match rifles has certainly advanced a very definite stage during the few weeks which have elapsed since this means of alignment was authorised. The Galilean combination of lenses, which can be employed without the use of a telescope tube, provides many of the advantages of the telescope. It is, however, doubtful whether the improved efficiency at the target points the way towards advances having any military value. However there is every reason to encourage experiments of a kind which may at any time produce valuable results. The eye strain due to viewing a swimming bull across 1,000 yards of heated ground is in any case so considerable as to justify the adoption of a suitable optical remedy. This function telescope sights perform, and it is a question for the future how much more they can be made to accomplish.

The shooting at the miniature ranges did not, in our opinion, reach a very interesting or instructive level during the meeting under review. For some reason not entirely apparent, the grade of scores produced did not rise to the level of previous years. To deliver one's shots into a 2-inch circle at 100 yards range is indeed a trying test of marksmanship; and this possibly accounts for the fact that the prize list is mostly confined to a few specialists who for trade or other reasons have mastered a difficult problem. One might have supposed that the growth of miniature shooting in rifle clubs throughout the country would have produced its due effect on the number of contestants for honours at the 100 yards distance; but so far from this being the case new faces were scarcer than usual, and many previous frequenters of this range found more congenial occupation in other sections of the camp. Most of the disappointment which we have experienced may be attributed to a lack of change in the rules, whereby the conditions which were thought good enough five years ago are still considered sufficient to meet the needs of the case to-day. There is reason to believe that this year's experience has been taken to heart, but it is even then by no means certain that the several reforms will be adopted.

At the revolver ranges the chief item of interest appears to have been the remarkably fine scoring of the naval contingent. This does not infer that the Navy as a whole excels in the use of the revolver, but it at any rate shows that at least one team of specialists exists which could make a successful showing against revolver shots drawn from all other sources. In the military section of shooting, things have proceeded on very much the same lines as in previous years. Some of the targets have been still further reduced in dimensions for the purpose of limiting the number of high scores made. When upwards of 1,000 competitors engage in a seven or ten-shot competition it stands to reason that a large number of highest possible scores will be produced. These may not represent a large proportion of the total contestants, but they are sufficiently numerous to produce an inconvenient multiplication of ties and a large number of divisions of insignificant prize money.

The bullseye has been reduced to the smallest possible dimensions. In fact it already possesses a smaller area of black for certain distances than can readily be seen. For many years the proposal to add an inner carton has been dismissed as undesirable, but now that we appear to have reached the limit of possible reductions in the bull it seems that the next step must be to provide an inner ring preferably counting as bull, accompanied by a slightly enlarged black area to count as the inner. This would limit the scoring areas outside the black to magpies and outers, but with suitably proportioned circles this should not produce any great difficulty. The mistake which has hitherto been made in proportioning the size of the inner carton to the bullseye has been to make it half the diameter instead of such a diameter as will represent half or even more than half the area. Such a system would penalise shots on the margin of the bull in a manner that would thin out the high scores. It would not, on the other hand, be so severe as to make the inside circle so small that a highest possible could only be obtained by a fluke.

CONTINENTAL DOINGS.

If the name of Liége occurs rather frequently in the following notes, it may be urged in extenuation that they were written in that busy and beautiful city—the Belgian Birmingham—which is not only the principal seat of the arms manufacture, but also, this year, the world's centre of gravity, owing to the highly successful international exhibition and congresses in connection with it.

Improved quality of Belgian Mine Explosives.—Some comparative statistics, compiled from official documents by M. V. Watteyne, Directeur des Mines, and M. L. Denoel, Ingénieur des Mines, show that the progress made, as regards safety in mines, by the improved quality of the explosives employed, has been considerable. Safety explosives now enter for one-third of the total consumption. At the same time the progress of electric shot-firing is very marked in comparison with other methods.

Krupp Exhibit at Liége.—The extensive show of the Fried. Krupp A-G. at the Liége Exhibition includes steel field pieces, with different breech-closing arrangements and hydraulic brakes; mountain guns for carrying on mule back; field mortars with variable recoil arrangements, and a cannon for Colonial use. There is also a large collection of projectiles and signal rockets, while armour plates of nickel and other varieties of steel show the effects of the trials to which they have been subjected.

Increase in the Liége Arms Manufacture.—In the collective arms exhibit at Liége, the official Banc d' Epreuves, or proof house, shows a graphic diagram, illustrating the progress made in the Liége arms manufacture during the last 85 years. For the eleven years ended 1831 only 1,587,511 arms were proved, after which, however, the number, though fluctuating, generally progressed from 330,488 in 1832 to 1,032,462 in 1884. In the following year the number fell a little, but the output attained 1,319,793 in 1886, from which year the production increased by leaps and bounds; and last year the number was 2,479,936, which is double that attained in the ten years from 1820 to 1830.

Herstal Arms Factory.—Last month several members of the Institution of Mechanical Engineers, in the course of its annual meeting, this year held at Liége, visited the Fabrique Nationale d' Armes de Guerre at Herstal lez-Liége, which was founded in 1889 by the Société des Fabricants d' Armes de Guerre réunis, and completed in 1891, extending over 9 hectares (22 acres), of which 17 are occupied by buildings. The works embrace three distinct departments for the production of arms, cartridges and cycles; and the average weekly production is 500 small arms, 250,000 cartridges and 200 cycles. This establishment, which was founded with the express object of rapidly executing large orders, has turned out Mauser rifles to the number of 150,000 for the Belgian Government, 50,000 for that of Brazil, and about 100,000 for Columbia, Uruguay, China, etc.

Armament of the Belgian Gendarme.—The gendarmes' traditional equipment is becoming completely modified; and he is now relieved from carrying his carbine into Court. Two different equipments are under consideration, one consisting of carbine, revolver and yataghan, while the other suppresses the carbine altogether.

Bullet-proof Breastplate.—It is perfectly true, according to *La Gazette*, that five hundred workmen at a factory near Fougère, in Brittany, are engaged in making for the Russian army, a new ball-proof breastplate, invented by an old sailor. The cuirass, which accomplishes its object, is made of steel plate, covered with several woven fabrics and provided inside with small spiral springs.

Liége Proof House.—Such is the activity in the arms manufacture at Liége that more than 15,000 barrels are passed daily at the proof house. This number includes about 3,500 revolvers, which, notwithstanding their six chambers, are only counted as one. In order to avoid accumulations, the administration of the proof house has been obliged to resort to Sunday working. It is estimated that the number of arms proved this year will exceed 2,800,000.

International Shooting Tournament, Brussels.—In 1861 the Belgian Parliament voted funds for a national shooting ground at Brussels, with 17 butts at 100 metres (109 yards) and 18 at 225 metres (246 yards) range, to which were added 5 butts at 500 metres (547 yards) in 1866, expressly for the British riflemen. In 1889 a new tir was inaugurated, that cost 1,168,000 francs (£42,720) covering 20 hectares (49 acres) and was provided with 42 butts of ranges from 100 metres (109 yards) to 600 metres (656 yards), the number of which has since been increased, while various improvements have been introduced.

This year, when Belgium is celebrating its 75th year of independence, unusual importance has been given to the contest; special competitions have been organized for the carbine and sporting gun; and the collective money has been raised to 135,000 francs (£5,400), while the King and Comte de Flandre have placed valuable prizes at the committee's disposal. Six electro-automatic scoring targets, invented by Lieutenant Bremer of the Belgian Army, have been set up with a range of 600 metres (656 yards); and an Army Challenge Cup, to be competed for yearly by the various regiments, has been instituted as in England. Further, a consolation prize, in the shape of a special watch-guard, will be accorded to all who have made a certain number of points without winning a prize.

There are this year about 5,000 entries; and, thanks to the Union des Sociétés de Tir de Belgique, the number of foreign competitors has increased from 15 or 20 to 300. An innovation is a match for ladies with the small carbine, for which there are 20 entries. Among the international competitions are the rifle and revolver matches, now shot for the first time at Brussels. The International Revolver Match was shot off on July 18 by Belgian, Swiss, French, Italian and Dutch teams, which achieved results in the order given, the winning team having made 2,485 out of 3,000 points. The Champion Prize for rifle shooting was won by M. Julien Van Aesbroeck, who has thrice won the International Rifle Cup.

Liége School of Arms.—During the visit of the Belgian Minister of Work to the collective arms exhibits at Liége, the president drew attention to the objects contributed by the pupils of the arms school which he said was a model of its kind, permitting armourers to select from among its prize-winners the capable and intelligent foremen they require. At the present time there are 260 pupils; but the number is increasing daily, so that it has been necessary to erect new buildings that will shortly be opened.

ROUND THE TRADE.

Messrs. Debenham, Storr & Sons announce their next sale of guns for Wednesday, August 16th.

Messrs. Moore and Grey inform us that they supplied the rifle with which the King's prize was won at Bisley.

Vigorite appears to be the name of a new explosive hailing from Bavaria, which has the usual qualification of being ten times more violent than the most powerful explosive.

The Directors of the Roburite Explosives Co., Ld., have declared an interim dividend at the rate of ten per cent. per annum for the six months ended the 30th June, this being at the same rate as last year.

Mr. E. H. Stone was unanimously appointed secretary of the Clay Bird Shooting Association, at the annual general meeting held last month. This involves a change of address to 68, Aldersgate Street, E.C.

Ammonal Explosives Ld. have sent us an intimation to the effect that patent No. 14,480 (1904) for an explosive containing aluminium has been abandoned as a result of the above firm's opposition to the sealing of the same.

The annual report of the Society of Miniature Rifle Clubs for the year 1904 states that during that period 59 clubs, with a membership role of 4,873 members, have been affiliated. This makes a total of 221 clubs with a membership of nearly 15,000.

We have been asked to ascertain whether a photograph was taken of the disturbance produced by the explosion of a quantity of dynamite below the sea near Alexandria, at or about the end of May. Possibly some of our readers may be able to supply the required information.

Messrs. W. H. Palfreyman & Co., of 17, Goree-Piazzas, Liverpool, have sent us a small booklet describing the process of case hardening with special reference to the firm's hydrocarbonated bone-black which is recommended as a suitable medium for supplying the carbon carrying material needed for the process.

We are asked to announce that the offices of the Gunmakers' Association have been transferred to Leighton House, 167-8, Fleet Street, E.C., and that the telegraphic address will in future be "Gunmakers" Sell, London. Mr. R. H. Angier, the new secretary, will deal with all business communications addressed to the Association.

We have received an advance sheet of the new *Sporting Goods Review* loading card for nitro powders, and although it is not for us to anticipate the contents of this useful table of values, we may at least be permitted to say that the new edition bears welcome evidence that powders are year by year being standardised nearer and nearer to a uniform method of loading.

The firm of W. W. Greener have sent us their new season's price list of cartridges, which contains particulars of sporting ammunition together with a blank order form. In the firm's opinion the uniformity generally attained in cheap factory loaded ammunition is in inferiority only. The opinion is also put forward that every gun possesses an individuality of its own requiring a special loading of cartridge. By quoting these opinions it must not be understood that we necessarily endorse them.

The Schultze Gunpowder Co., Ld., have sent us proofs of a game card which represents in our opinion a great improvement on the ordinary book. The particulars are printed on a stiff white card ruled on one side for the names of the guns, and carrying an analysis of the bag on the other. These cards can obviously be distributed amongst the members of a shooting party at the commencement of the day, and the details can be transferred at leisure to the game book or shooting diary.

We have received from the National Rifle Association a pamphlet containing the whole of the scores made at the recent Bisley meeting, these particulars having previously been withheld until the issue of the annual report in the following February. This book will be appreciated by all who took part in the meeting, not only because it is an early and authentic record of the scores made, but because it bears striking evidence of the desire of the N.R.A. to do everything possible for the convenience of members and competitors.

Messrs. Cogswell & Harrison's new shooting school adjoining Colnbrook station has just been opened. From the large amount of time and money which has obviously been expended in the preparation of the site, it is clear that this ground is intended to occupy a premier position. Colnbrook station is situated on a small feeder line which joins up with the G.W.R. main line at West Drayton. The ground is also accessible from Staines and West Drayton stations by the firm's motor car.

In turning over some back numbers of *Arms and Explosives* we came across an article on air-guns in the issue of December, 1894. Considering that upwards of ten years have elapsed since the article in question was written, it is interesting to note the following words which have almost a prophetic significance:—"The chief reason for which we would recommend to the gun trade more attention to the sale and improvement of these so-called toys, is that they have great value as an educating and popularising medium in the art of shooting. . . . The question of improved air-guns is not one of world-wide importance, but we would direct attention to it as one of those side issues of ordinary trade worthy of development."

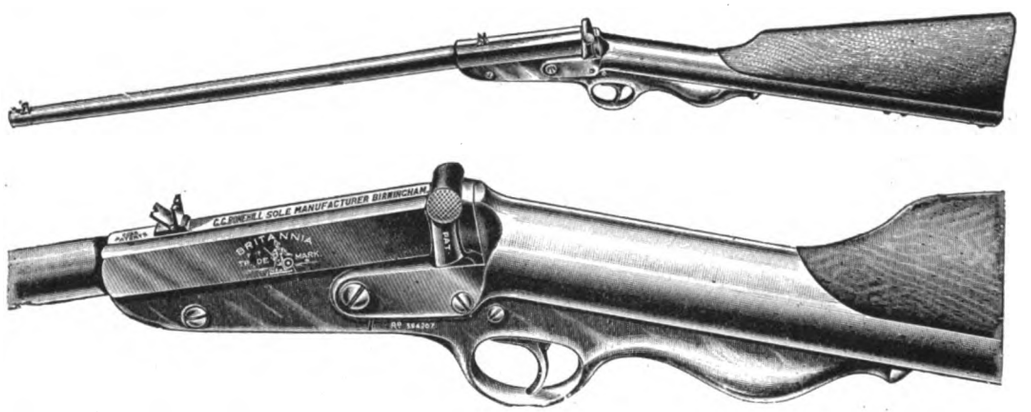
The National Rifle Association is believed to be in a somewhat delicate position with regard to certain of the rifles used at the miniature contests at Bisley. These competitions are mostly controlled by restrictions of a highly technical character, as to be impossible to enforce without a gunmaker for range officer. Certain prizes appear to have been awarded to competitors whose scores have been challenged because of specific infringements of the rules laid down. These objections were quashed by the committee whose duty it was to consider them, and the result in one instance at least is that the Association has been threatened with High Court proceedings unless the prize is awarded in accordance with the terms of the printed regulations.

It is understood that the chances of arranging an amalgamation between the Society of Miniature Rifle Clubs and the National Rifle Association on satisfactory terms are very slender. The society has accordingly determined to pursue an energetic policy of rifle shooting encouragement on its own behalf; and plans have already been formed for instituting a series of miniature meetings in different parts of the country. The following fixtures have been approved:—At the open range of the Southfields Miniature Rifle Club on the 2nd prox., at the Market Hall (nominally an open meeting, but not so in the ordinary sense of the term), Tavistock, Devon, on the 9th prox., at the range of the Caerleon and District Miniature Rifle Club at Caerleon, Monmouthshire, on the 23rd prox., and at Derby on the 7th of October. We trust that all who are interested in the development of miniature rifle shooting will make a point of supporting these meetings in one form or another.

The Kynoch catalogue for the current season has just been issued. The chief novelty in shot gun ammunition is the addition of the Primax cartridge which is of gastight quality and sells at a fixed retail price of 8s. 6d. per hundred net., as against 7s. for the Bonax. Amongst rifle specialities we notice a ball cartridge for ball and shot guns with a flat metal base and a conventionally formed nose, having a large cavity in the centre of the bullet. Among new express cartridges we notice the ·450 and ·360 No. 2 nitros. The ·350 Rigby seems to have dropped out of the catalogue. The reduced charge ·303 cartridge continues to be specified with a 180-grain bullet, which is 40 grains more than the N.R.A. maximum. It should be noted, in regard to the maximum sizes of express cartridges, that the thickness of head of the ·400 Jeffery 3-inch has been reduced to ·065 in. The catalogue this year concludes with an appendix, giving in condensed form a summary of the cartridges specified in the catalogue covering the powder charge, weight of bullet, price, and finally a reference to the page where the full particulars may be found.

A NEW AIR RIFLE.

THE accompanying illustrations afford an excellent idea of the new air rifle which has lately been introduced by the firm of C. G. Bonehill. Special importance is to be attached to this new development for two reasons, first, because it represents a serious attempt on the part of an English firm to make a proprietary article on the interchangeable basis, and second, because the rifle itself affords evidence of a comprehensively arranged design, aiming at a high standard of perfection in detail. The general outline of the rifle follows very closely that of the old "Gem" model as distinguished from the "Musketeer" system of construction which is associated with the name of Messrs. Lane Bros. The Gem and Britannia models have the advantage of a compact overall length of 36 ins. The Lane gun is some 6 in. longer, by reason of the fact that the plunger mechanism lies



in front of the trigger and so carries the barrel forward by about this distance. The short length construction produces a handy and well-balanced arm, which will pack into a very small space. On the other hand, the longer rifle benefits from the advantage of having the backsight some 6 ins further from the eye than can be arranged with the short model. With a Lyman sight fixed to the grip of the Britannia air rifle, a very nice sporting pattern of arm is produced, but such a combination suffers from the disadvantage of all break-down weapons when used with one sight on the barrel and the other on the stock. The slightest difference in the locking at the joint in closing the breech is magnified to a considerable error on the target. One might almost lay down that the Lyman sight is not seen at its best on a breakdown weapon of any kind.

Turning to the specially meritorious details of the new air rifle's construction, we find most prominently before us the advantage of a simple means for renewing worn or broken springs. The piston cylinder is carried underneath the stock right to the toe of the butt. The orifice is finished off with a knurled cap held in place by a keeper screw. The latter may be taken out by using a halfpenny as a screwdriver. A penny-piece will then allow for unfastening the knurled cap, which is held in place by a bayonet joint. Springs may thus be replaced without the slightest difficulty or need for special appliances. This is a great advantage, so long as the strength of the spring exercises so imporrant an influence upon the efficiency of the rifle. Another important device comprised in the construction of the new rifle, is a strong and substantial trigger mechanism which has been specially designed to overcome the difficulties incidental to the release of the powerful plunger spring with a short and crisp movement. The cocking lever has been cast with a series of nice curves and outlines, affording a pleasing appearance and a comfortable hand grip. The sights fitted comprise the 60 deg. V and the round bead, which for some reason we have so far been unable to discover, has been found to give the best alignment for indoor club ranges using an artificially illuminated target.

In the descriptive pamphlet which is supplied to intending purchasers of the rifle, a page has been devoted to a series of components, all of which are fully illustrated and described, with a list of prices on the opposite page. This important essential of a cheap proprietary weapon shows that the manufacturing problem has been tackled on the proper lines. We feel inclined, however, to dissent from one of a series of illustrations shown on another page for the purpose of instructing the user how to manipulate the rifle. The illustration shows the method of inserting the pellet; the rifle being clasped with the barrel in the left hand, the right hand being used for inserting the pellet. Should the trigger by any chance fail to retain the spring, it might easily happen that the breech would snap home and crush the fingers. While we do not suggest for a moment that the Bonehill air rifle would ever misbehave itself in this manner, we feel quite justified in recommending an alternative manipulation, which is not open to this objection. The back end of the stock should be passed under the right armpit, and be firmly clasped therein. The right hand should then grasp the muzzle in such a way that even if the catch lost its grip the rifle could be stopped from closing. The left hand by this method remains free for inserting the pellet. The latter portion of the pamphlet is taken up with some very interesting pages devoted to steel targets, which register a bullseye hit by the striking of a bell, other targets with ingenious methods of bullet stopping showing that great care has been taken in the designing of requisites. Altogether we feel every justification for congratulating the firm of Bonehill on having produced a most workmanlike weapon which reflects on them great credit for the skill and enterprise embodied in its design and manufacture.

THE EVOLUTION OF THE ·303 AMMUNITION.

BY F. W. JONES.

No one who takes an interest in our national arm can be oblivious to the fact that we are on the eve of a change in the service rifle ammunition. The Bisley meeting which has just closed and the reports current that Government officials were watching the shooting of M.D. Cordite at long ranges would remove all doubt if any existed. It is said that there is to be a change in the explosive used in small arm cartridges, and also an increase in the specified ballistics. In all this there is nothing to surprise the expert: the marvel is rather that the change has been so long delayed. America with a rifle of almost identical bore, sometime ago raised the standard velocity of their bullet about 200 f.-s. We should do well to follow their lead.

When changes are determined upon sometimes the true object is lost to sight, and the so-called improvements are carried out for mere form's sake. Such subjects have to be viewed from many aspects, and every effort must be made to avoid the perpetration of unsound theories. No one likes to see a new model settled, and after a short experience be condemned as a fad, as has been the case with certain features of the new short ·303 rifle. The careful weighing of past experiences and a knowledge of the kindred subjects of ammunition and explosives should prevent errors of this kind from creeping into the final decisions of the authors—of the new ·303 cartridge.

The consideration of possible changes in a particular cartridge must be made with due reference to the rifle in which they are to be used. The ·303 rifle has admittedly many faults. From the cartridge point of view the permissible pressure is the most important. This, however, may be dismissed, because there are many other considerations which should determine the service pressure and these in relation to the explosive in view, limit it to that which may with safety be allowed in the present ·303 rifle. Of course, to make a rifle obviously weak is absurd, and no doubt in years to come the authorities will appreciate this and make the needful improvement. We must in the meantime cultivate the patience of a Fabius: the quality of inertia is not restricted to material systems.

If the ·303 cartridge is to be improved we may well review the improvements which might and ought to be included. The case might be increased in size to permit loading for very high ballistics. This is not desirable. Small bore cartridges were introduced to reduce the weight of ammunition; and to deviate from the decisions arrived at can only be justified by advantages not attainable by any less objectionable course. We, therefore, lay down that the case need not be increased in size or weight. The cap is objectionable both in size and priming composition. It is unnecessarily large in diameter and contains a comparatively large quantity of a weak and constitutionally bad mixture. The original ·303 case had a ·215 in. diameter cap and we can only imagine that with the advent of Cordite and the fears then existing regarding the irregular ignition or detonation of a compound containing over half its weight of nitro-glycerine, a priming of the mildest character was considered essential. The small cap would not take a sufficient charge of this weak mixture, and one of ·251 in diameter was introduced. However, fifteen years' experience has shown that gelatinized gunpowders are not liable to great variation in pressure even with excessive variation in strength of cap. That the present cap is bad is abundantly proved by the experiences gained from using the old ammunition the Government have been dumping on rifle clubs for some time past. Missfires and hangfires and low shots are common, being due undoubtedly to the deterioration of the weak cap specified for use in the ·303 case. The cap should be improved, a simple and more stable mixture adopted and the size reduced to permit of the case being made without the present sudden change of thick metal at the head to thin walls immediately adjoining. It is true a convex base will cause the cords to lie in the case with the centre highest, but this will not affect the shooting.

As regards the bullet, it has a smaller sectional density than the old Martini bullet, and nearly all military small bores. It is consequently at a disadvantage in ranging power, but not much. An addition of 10 grains to its weight would place it equal to any of its analogues in this respect. This would increase its length and necessitate either an alteration in the length of the cartridge and magazine, or else the insertion of the bullet further in the case. The latter course seems objectionable and as the velocity for any given maximum breech pressure would be higher with the 215 grain bullet than with one of 225 grains weight the advantage of the heavier bullet would be very small. One may accordingly conclude that there does not appear to be sufficient reason for changing the weight of the bullet.

The most desirable improvements of the ·303 ammunition thus resolve themselves into a higher range of ballistics and an improved explosive, accuracy being included under the former. The velocity given by the ·303 cartridge will without doubt be increased: the question is how much this increase ought to be. The maximum velocity will be limited by the pressure. The present ·303 is specified not to exceed on the average 16½ tons at 60° F.; but it is known that in tropical countries the pressure rises to about 19 tons. If the pressure of the new explosive is not more susceptible to temperature than M.D. Cordite the limit might be raised even to 18 tons. Taking this figure as the new limit there would be very little difficulty in loading cartridges to give a muzzle velocity of 2,400 f.-s. The question is whether the velocity should be placed at so high a level. The elements incidental to the increase of velocity are accuracy, flatness of trajectory, ranging power and striking energy, whereas the erosion due to the bullet and powder gases as well as the heating effects on the barrel must determine the practical limit.

Taking accuracy first, Bisley has proved indisputably that high velocity in the ·303 improves the shooting. Opinions differ as to why this is so. It may be, as Mr. Housman's experiments on "flip" showed, viz., that the compensating effect of "flip" with ·303 cartridges giving over 2,100 f.-s. is such that any given variation in velocity produces less effect on elevation than would result if "flip" were absent. The researches of Professors Cranz and Koch do not corroborate this, but Bisley supports Mr. Housman. On the other hand

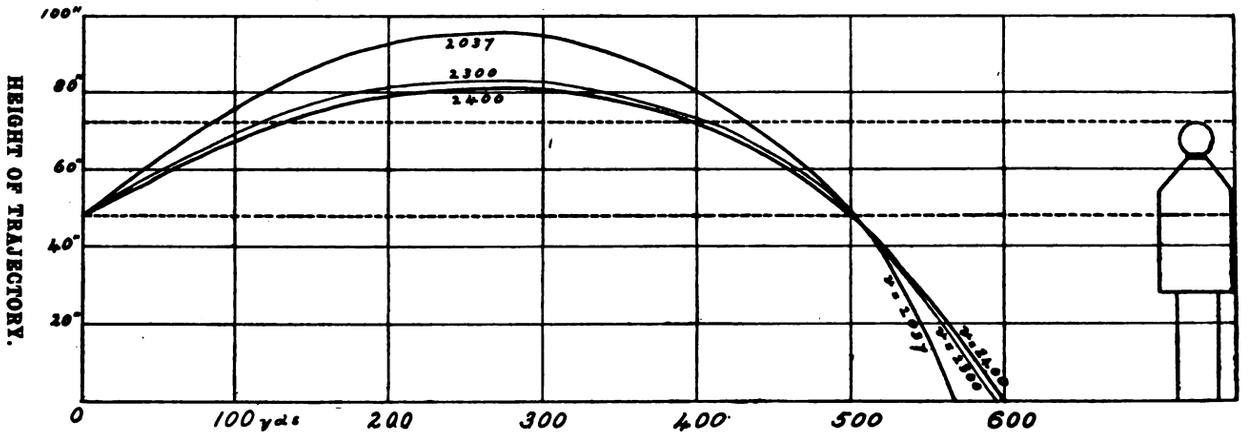
the higher rotational velocity of the bullet may have an influence, as may also the materially higher striking velocities of the high velocity cartridges at long ranges. Be that as it may accuracy does not demand a muzzle velocity higher than 2,300 f.-s.

The advantages of a flat trajectory may be argued from several points of view, here we have selected to consider what error of estimation the ballistics allow to a man firing at an object an unknown distance away. For instance, suppose a marksman was to fire at an object six feet high having the outline of a man. He estimates the range at 500 yards, and he fixes his sights for this distance. Assuming his aims to be at a point four feet from the ground we have to ascertain

to the 2,037 f.-s. cartridges, but not materially better than the 2,300 f.-s.

We have yet another point to examine, viz., the ranging power and striking energy. Both these are shown by calculating the remaining velocity at, say, 1,000 yds. which with $n = 0{\cdot}80$ are as follow :—

Muzzle Velocity.	Velocity at 1,000 yards.	Energy at 1,000 yards.
2,037 f.-s.	875 f.-s.	365 foot lbs.
2,300 ,,	925 ,,	408 ,,
2,400 ,,	944 ,,	425 ,,



what error of distance the marksman may make and yet be recorded a hit. To enquire into this we have taken the ·303 with muzzle velocities of 2,037, 2,300 and 2,400 f.-s. respectively. The table below gives the angles for the various ranges. The values for the lowest velocity are those of Mr. Metford and we have taken the same co-efficient of reduction as he did for the other values, viz., $n = 0{\cdot}80$:—

Range.	Angle in minutes. M.V. 2,037 f.-s.	Angle in minutes. M.V. 2,300 f.-s.	Angle in minutes. M.V. 2,400 f.-s.
100 yards ..	4·4	3·5	3·1
200 ,, ...	9·6	7·1	6·5
300 ,, ...	15·8	11·5	10·7
400 ,, ...	22·9	16·8	15·6
500 ,, ...	31·0	23·1	21·3
600 ,, ...	40·1	30·4	27·9
700 ,, ...	50·3	38·7	35·5
800 ,, ...	61·7	48·1	44·2
900 ,, ...	74·3	58·7	54·1
1,000 ,, ...	88·1	70·5	65·2

The difference in angle is considerable, but rifles sighted for each kind of ammunition remove the advantage in a great part. The accompanying chart of trajectories shows this.

We have assumed, for the sake of simplicity, that the gun is fired 4 ft. above the ground line, and that the point of aim is the same height upon the object. We may now see what advantage the one ammunition gives over the other. The cartridges giving 2,400 f.-s. would hit the object at a distance between 400 yds. and 600 yds., the 2,300 f.-s. between 405 yds. and 495 yds. and the 2,037 f.-s. between 430 yds. and 570 yds. From this one might say that the flatness of the trajectory of the 2,400 f.-s. cartridges are much superior

All the above goes to prove that if the attainment of high velocity is properly related to the object in view, there is no need to raise the ·303 muzzle velocity more than from the present standard of 2,078 f.-s. to 2·300 f.-s. The former is the muzzle equivalent of the standard observed velocity 2,000 f.-s. corrected to the muzzle taking $n = 1{\cdot}0$, a value found by experiment to be correct for the early stages of the ·303 bullet's course. The acceptance of 2,300 f.-s. instead of any higher value appears to be all the more reasonable when erosion, due to the velocity of bullet and powder gases as well as the heating of the barrel are considered. No matter how low the temperature of combustion of the explosive may be, the smaller the charge the less is the heating, and it is obvious that the lower the velocity the less is the erosion. On this question of heating, the writer in 1900 made M.D. tape Cordite of 25 per cent. nitroglycerine with such a granulation that 31 grains gave the standard velocity. Experiments at that date on comparative barrel heating showed tha t 50 rounds fired at the rate of 15 per minute caused the barrel to rise in temperature 270 deg. F. with service Cordite, and only 160 deg. F. with M.D. Cordite. Of course a greater charge of the latter would not show to such an advantage.

We have lastly to consider the explosive. Mark I. Cordite we may say is doomed, it has been replaced in nearly all Ordnance, and it is at last to give way for a better powder in rifle ammunition. When a change like this is proposed all sorts of suggestions comes to one's mind; but the merit of a gunpowder depends on so many things besides the composition, that the latter can well be settled by outside considerations so long as the temperature of combustion is low enough. Manufacturers are making daily large quantities of

M.D. composition, and unless this mixture were radically bad there is every reason for its adoption for the rifle powder. Experiments have been in progress for about 12 months both with Mark I. and M.D. Cordite, with a granulation other than cord, and these experiments have shown that velocities can be obtained as high as desirable. People generally make experiments in grooves. Cordite was originally made in cords; why, no one knows. But may be the true explanation lies in the fact that a round hole is the easiest one to make. Having got our powder in cords, loading machines were invented to get over the difficulty. The result has been that loading machines for granular rifle powders have never been developed in this country. The most accurate machines we have are those for cutting lengths correctly. At present the M.D. powder is consequently made in lengths. This is not wise.

With Cordite reels belonging to the same consignment, a variation in the charge is needed to give constantly standard velocities, and there is no guarantee that the reel remains the same throughout. The difference is admittedly not great, but in grain form this small difference could not exist, because the powder can be mixed in bulk within very close limits and the proof of a single sample is a conclusive guide as to the behaviour of the lot. With M.D. tape this difficulty of blending will be even more serious, and attended with no compensating advantages. Success will not follow the introduction of M.D. Cordite unless it is made by cutting the tapes into lengths equal to the width. Much has been written to show that tape granulation, owing to the slight reduction of burning surfaces up to complete combustion, is responsible for the high ballistics obtained. Actual experience is better than unproved theory. The writer has shot samples of M.D. Cordite granulated in flat grains, and obtained in the ·303 a muzzle velocity of 2,400 f.-s., with an average pressure less than 18 tons. Samples in tape form have not yet beaten this record. There is another reason why tape granulation will not succeed. Probably it has been the experience of few to fire a cartridge, the powder of which has ignited and then gone out, leaving the bullet in the barrel. One instance came to the writer's knowledge years ago, and examination showed that the blast of the cap had broken up the grains near the flash hole of a powder like Troisdorff. This being so, what is likely to happen with the long flat, rather brittle tapes of M.D.? In fact, is there any other explanation of the comparatively irregular pressures observed with cartridges containing tape M.D. Cordite?

If then, the ·303 cartridge is made with a smaller cap and the head of the more usual form, and this is loaded with a granular powder of M.D. composition to give a velocity of 2,300 f.-s., with an average pressure not exeeding 17½ tons, may we not say that it has taken a great step in its evolution.

At the Normal Powder and Ammunition Co's. range at Hendon, an interesting demonstration of the qualities of the Fidjeland automatic rifle took place on July 18th. This weapon is of Norwegian origin, and Mr. A. Kallevig, of Christiania, was in charge of the trials. Four models were shown, each embodying improvements, chiefly in the way of simplification of mechanism. Of these, two only, the latter patterns, were shot. The rifle is of the gas-operated automatic type. Considerable stress was laid upon the noticeably slight recoil, but as this is attributable chiefly to the weight of the arm and to the buffer effect of the recoil spring, it is not to be regarded as a novel feature. The parts used in the mechanism are few and strong, and the automatic locking and unlocking of the breech bolt is contrived with conspicuous ingenuity and success. The neat appearance of the weapon throughout is greatly in its favour, while the complete boxing-in of the automatic mechanism by the long military fore-end should, and apparently does, render it almost impervious to dust and grit. The calibre of the rifle is 6·5 mm., taking a rimless cartridge, apparently the Krag-Jorgensen. The magazine contains 5 cartridges, loaded either singly or from a clip. In a long series of shots the rifle No. 4, the latest pattern, acted perfectly, and with No. 3, an earlier model, the only failure was one misfire, rectified by ejecting the cartridge by hand, the automatic operation being resumed with the next shot after a minimum of delay. The trials were not arranged on any exhaustive scale, but the performances of the arm created a distinctly favourable impression. Afterwards attention was devoted to the Browning automatic gun, and some successful experiments were carried out with a military field telephone invented by Captain Dahl, and used by the Norwegian Government. Amongst those present were the Duke of Wellington, the Earl of Denbigh, Lord Douro, H.R.H. Prince von Liechtenstein, Sir John Furley, and others.

TRADE MARKS.

ADVERTISED. JULY 5—26, 1905.

272,175. A diamond-shaped device representing a miner watching the effects of a blast. To apply to explosive substances. The Explosives and Chemical Products, Ld., London. April 20, 1905.

273,778. } The word COSONOID. To apply to arms, ammunition and
273,779. } explosive substances. Cogswell & Harrison, Ld., London. June 22, 1905.

273,795. } The word RECOILITE. To apply to guns, rifles and
273,796. } cartridges. Holland & Holland, Ld., London. June 22, 1905.

REGISTERED. JUNE 22—JULY 19, 1905.

271,371. Sprengstoffwerke Glückauf, Ag
270,481. W. H. Butcher & Co.
272,516. Kynoch Ld.

APPLICATIONS FOR PATENTS.

JUNE 19—JULY 15, 1905.

18,261A/04. Ordnance. A. T. Dawson and G. T. Buckham. (Date of application under Rule 9, August 23, 1904).
12,635. Protection of Barrels from Corrosion. C. C. J. Topp.
12,658. Removal of Gases. F. Bohn and F. Bündgens.
12,720. Smokeless Powders. A. T. Cocking and Kynoch Ld.
12,754.* Sights. J. J. Frie.
12,794. Explosive Projectiles. T. G. F. McCombie and J. B. S. McIlwaine.
12,892. Smokeless Powders. A. T. Cocking and Kynoch Ld.
12,893. Smokeless Powders. A. T. Cocking and Kynoch Ld.
12,894. Smokeless Powders. A. T. Cocking and Kynoch Ld.
12,902. Range Finder. H. D. Taylor.
12,919. Small-Arm Sights. T. R. R. Ashton.
13,060. Smokeless Powders. A. T. Cocking and Kynoch Ld.
13,089.* Automatic Arms. Fried. Krupp, Ag. Grusonwerk. (Date of application in Germany September 13, 1904).
13,092.* Submarine Mines. T. Novero.
13,097.* Automatic Arms. Fried. Krupp, Ag. Grusonwerk. (Date of application in Germany September 13, 1904).
13,104.* Ordnance. Fried. Krupp, Ag. Grusonwerk. (Date of application in Germany September 13, 1904).
13,106.* Ejecting Mechanism. Fried. Krupp, Ag. Grusonwerk. (Date of application in Germany September 13. 1904).
13,116. Ordnance. A. T. Dawson and G. T. Buckham.
13,117.* Cartridge Ejector. Fried. Krupp, Ag. Grusonwerk. (Date of application in Germany September 13, 1904).
11,400A. Adjusting the Pull of Sporting Guns. J. Robertson. (Date of application under Rule 9. May 31, 1905).
11,400B. Locking Device for Small-Arms. J. Robertson. (Date of application under Rule 9, May 31, 1905).
13,170. Gas Checks. W. Clark. (Agent for *P. Riss*).

13,297. Removal of Fouling from Gun Barrels. The King's Norton Metal Co., Ld, T. A. Bayliss, H. W. Brownsdon and H. M. Smith.
13,340.* Torpedo Charges. C. Claessen.
13,385.* Firing and Small-Arms. F Dupont and H. Schoonbroodt.
13,453.* Shell Fuses. C. P. Watson.
13,459. Machine Guns. W. Schmied.
13,523. Shooting Teacher. A. Whitney.
13,627.* Projectiles. C. F. and H. E. Cowdrey. (Date of application in U.S.A. November 10, 1904).
13,668.* Ordnance. A. P. Jones. (Agent for the *Bethlehem Steel Co.*)
13,680.* Gun Locks. O. Imray. (Agent for *Colt's Patent Fire-Arms Mfg. Co*)
13,901.* Explosives. O Silberrad.
13,969. Explosives. O Silberrad.
13,987. Projectile Fuse. W. Beardmore & Co, Ld., and A. Bremberg.
13,988. Projectile Fuse. W. Beardmore & Co., Ld., and A. Bremberg.
13,991. Small-Arms. W. A. Dawson and W L. White.
14,101. Rifle Sights. M. Blood.
14,133. Shrapnel. E. Rubin.
14,223.* Machine Gun. J. Lauber.
14,335.* Fire-Arm Sights. C. S. Daniel.
14,481.* Safety Explosives. C. E. Bichel.
14,528.* Ordnance. Fried. Krupp, Ag. (Date of application in Germany October 13, 1904).
14,545.* High Explosives Marquis Roberto Imperiali.
14,587. Magazine Rifles. The Birmingham Small-Arms Co., Ld., and G Norman.
14,588. Air Gun Sights. The Birmingham Small-Arms Co., Ld., and G. Norman.
14,601. Recoil Guns. H. H Mulliner and A. C. Lochenies.
14,627. Automatic Sighting. F. T. Fisher and W. J. Griffiths.

*These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

JUNE 29th—JULY 20th, 1905.

COMPILED BY HENRY TARRANT.

6,417 (1904). **Machine Gun Feed Mechanism.** A. W. Schwartzlose, Germany. The feeding wheel of the cartridge feed mechanism of machine guns is so arranged that it not only effects the step-like advance of the cartridge belt but it also draws the cartridge from the band to a position behind the barrel. The special devices hitherto employed for this purpose are thus dispensed with. Accepted June 16, 1905.

13,622 (1904). **Floating Target.** W. J. Hunter, Lewisham. A floating target adapted to be steadied when in the water by a well situated in its boat-like base. Water is admitted to the well and acts as ballast. Accepted June 16, 1905.

14,074 (1904). **Target Machinery.** A. Winser, Southsea. Two targets are arranged upon the opposite ends of a frame which works around an axle attached to two uprights. The targets work in see-saw fashion, but no matter what the position of the frame, the targets are always vertical by reason of being weighted beneath their bearings. When one target is in the firing position the other is in the trench in a convenient position for cleaning. Accepted June 22, 1905.

14,694 (1904). **Range Finder.** J. W. Rule, Midlothian, and C. E. Liles, London. A telemeter adapted to be used also as a clinometer, a level, or as a surveying instrument. Combined with the telescope is a tube containing a second lens and two or more mirrors for reflecting the image of the object to the eyepiece of the telescope. An angle, and thus the range is determined when the images are made to coincide. Accepted June 29, 1905

15,053* (1904). **The Manufacture of "bulk" Smokeless Powders.** A. T. Cocking, and Kynoch Ld., Kynoch Town, Essex.

16,707 (1904). **Armour-Piercing Projectile.** H. Hanbridge, Sheffield, and W. Walker, Huntly, N.B. In order to adapt shell for the piercing of present day armour-plates, the patentees modify the shape of the nose. Instead of forming a sharp nose as in the ordinary way a concave depression or hollow is constructed. The hollow is of such depth that when the shell has been hardened all over, the concave head may be tempered. This form of nose, it is said, bites better when striking a plate obliquely. Accepted June 29, 1904.

18,504 (1904). **Ordnance Sighting Gear.** Sir W. G. Armstrong Whitworth & Co., Ld., and A. G. Hadcock, Newcastle-on-Tyne. Mechanism for ordnance sights for correcting the errors of sighting which arise when the axis of the trunnions is inclined to the vertical plane is described in this patent. The sight pillar is attached to one trunnion end by a coupling which forms a universal joint. The pillar may be moved to a limited extent until it has been caused to assume a vertical position. Accepted June 29, 1905.

18,898 (1904). **Working of Ordnance.** P. M. Justice, London. (Agent for *The Bethleham Steel Co., U.S.A.*) Two handles with gearing are so arranged adjacent to the sighting device that the operator may conveniently train the gun and use the sighting device simultaneously. At the same time he is in readiness to discharge the gun, an electric firing circuit closer being situated on one of the handles. Accepted June 8th, 1905.

19,933 (1904). **Fore-sight Protector.** G. L. Jefferies, Birmingham. A fore-sight protector attached to and retained always upon the barrel is so arranged as to be capable of rotary and sliding movements on the barrel end. The rotary movement covers or exposes the foresight, and the sliding movement locks the protector in either of these two positions Accepted June 29, 1905.

20,208* (1904). **Duplex Single-Trigger Mechanism.** J. Carter, Birmingham.

22,811 (1904). **Ordnance Sighting Mechanism.** P. de Loidenfelt, and E. Ternström, Belgium. Sighting Mechanism for ordnance is arranged in such a manner that the line of sight may be rendered fixed or independent with relation to the gun. The arrangement allows of keeping the line of sight directed towards the object after the firing angle has been given to the gun and the correction of aiming compensating for the inclination of the trunnions of the gun has been effected. Accepted June 8, 1905.

25,030 (1904). **Wire Cutting Attachment for Rifles.** A. Wallis, Woolwich. An attachment for rifles consisting of a metal clip (surrounding the wood beneath the barrel end and adapted to hold the attachment to the rifle) to which is pivoted a lever of hardened steel provided with a cutting edge. This cutting edge is adapted to sever barbed wire with the help of a second cutting edge on the clip. Accepted June 8, 1905.

1,899 (1905). **Ball-bearing Rifle Cleaning Rods.** F. J. F. Wilson, India. An implement for cleaning rifles consisting of a rod, and a jag for carrying the cleaning medium, such as tow. The jag is mounted on ball-bearings, as also is the handle, so that both these parts will rotate freely relatively to the rod when the implement is being used to clean the bore of a rifle. The tow is thus allowed to accomodate itself more completely and easily to the twist of the rifling. Accepted June 15, 1905.

2,187 (1905). **Detonating Warner.** L. A. Audibert, France. A burglar trap consisting of a detonating lock. When an attempt is made to force a door to which the lock is attached a lever is dropped and a detonator is caused to explode a small bomb. Accepted June 8, 1905.

3,181 (1905). **Manufacture of Cartridge Cases.** Rhenische Metallwaren und Maschinenfabrik, Germany. An initial hollow body of brass or other copper alloy constituting the base part of a cartridge case and having thickened parts at the desired points in the base is produced from a solid cylindrical block smaller than the hollow body produced. This block is subjected, while heated to redness, to the action of a pressing mandril and a matrix having the required recesses for producing the thickened part. The hollow body is produced by a single pressing operation. Accepted June 8, 1905.

4,734 (1905). **Laying Mechanism of Ordnance.** A. Reichwald, London (Agent for *Fried. Krupp, Ag., Germany*). A method of reducing the weight, cost and sensitiveness of the laying mechanism of ordnance, consisting in connecting the shaft of the bevel wheel operating on the laying screws with the shaft operated on by the hand wheel, by a universal joint. Superfluous bevel wheel gear is eliminated and space economised. Accepted June 29, 1905.

5,578 (1905). **Rifle Carrying Strap**. G. R. Cawley, London. A method of providing for the convenient carrying of a rifle when on horseback, consisting in attaching to the ordinary military sling an auxiliary strap designed to ride on the right shoulder whilst the ordinary sling rests on the left. A bucket attached to a band passing round the horse's body, is designed to take the butt, and so the weight of the rifle. Accepted June 8, 1905.

6,651* (1905). **Modified Explosives containing Aluminium**. H. J. Haddon, London (Agent for *G. Roth, Vienna*).

7,799 (1905). **Ordnance Sighting**. Fried. Krupp, Ag., Germany. A method of eliminating the influence of the oblique position of the wheels of ordnance of the high-angle firing type which are usually sighted by means of a spirit level quadrant. The axis upon which the sighting device proper rocks when the oblique position is eliminated, is in its turn capable of being rocked independently of the gun on an axis parallel to the axis of the horizontal trunnions of the gun. Accepted June 8, 1905.

10,015 (1905). **Gun Carriage Improvements.** Fried. Krupp, Ag., Germany. A modified form of "seizing" apparatus—*i.e.*, apparatus employed to relieve the elevating and traversing gears of transportable ordnance from shocks arising when the gun is moved from place to place—is described in this specification. The improved device is claimed to be particularly reliable in action. Accepted June 15, 1905.

10,162 (1905). **Safety Device for Percussion Fuses**. Fried. Krupp, Ag., Germany. A percussion fuse is provided with a safety device designed to be thrown out of action by centrifugal force, and this device is prevented from returning and rendering the fuse inoperative when the shell strikes. A spring flap is so arranged that, when the safety device is removed by the rotation of the shell, it is caused to block the path of the movable part of the device, and so prevent its return to the locking position. Accepted June 22, 1905.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

THE MANUFACTURE OF "BULK" SMOKELESS POWDERS.

15,053 (1904). A. T. Cocking and Kynoch Ld., Kynoch Town, Essex. A nitrocellulose powder designed to be used for sporting purposes is dealt with in this specification. The patentees have endeavoured to obtain a "bulk" powder, *i.e.*, a powder in which the space occupied by a given weight is great in relation to its explosive power, so that when the charge is measured by bulk, the same measure may be used as is required for less powerful black powder.

Two methods have been proposed for obtaining bulk powders. The first consisted in mixing with the cellulose paste a suitable diluent intended to increase the bulk of the powder in relation to its power. The diluent, however, created objectionable smoke or fume. The second proposed method was one by which some substance which would increase the bulk of the powder in relation to its power, was incorporated with the nitrocellulose during manufacture, but which would be dissolved out after the powder had been granulated. This process, the patentees say, is a troublesome one, and is not altogether satisfactory. Their main idea, therefore, is to produce a nitrocellulose powder of the required density free from any such defects and difficulties of manufacture.

When nitrocellulose paste is mixed with cold water, a powder having a small bulk is produced. The patentees have discovered that if the temperature of the water is raised, and if the nitrocellulose is made with a very large bulk of solvent, and granulation is effected by mixing the warmed water and the paste, a powder of greatly increased bulk is obtained without difficulty. The viscosity of the paste or "solution" as it is called, is regulated to accord with the temperature of the water (or steam) and the rate of stirring used, to obtain the desired bulk

A certain quantity of nitrocellulose is taken, having 12 to 12½ per cent. of nitrogen, and with this is incorporated several times its own weight—four or five times—of acetone until a uniform solution is obtained of about the constituency of treacle. With a given quantity of this solution, double its bulk of water at 65° C. is used. A small quantity of the water, just sufficient to cover the solution, is first added, and the stirring is begun. Then while stirring violently the rest of the water is poured in. Quicker stirring tends to produce lighter density in the powder and the rate at which the water is added has much effect in determining the size and uniformity of the grain produced. Hotter water also tends to the production of a lighter density grain with a given viscosity of solution. Decreasing the viscosity leads to the production of grains of less density. The temperature of the water, the rate of stirring, and the viscosity of solution have thus to be suitably chosen in order to produce the necessary density of grain. After precipitation the liquid is poured off, and the powder is dried and sifted. Or the solvent may be first recovered by raising the temperature of the mixed liquids by means of steam until the acetone has been distilled. The water remaining may be then run off by gravitation. The larger grain, which is found to be slightly denser, may be broken up. This greater density may be proportioned by initially making the powder less dense. About 30 grains of an ordinary sporting powder, such as is above described, should occupy the unit measure. Any other solvent besides acetone may be used, but the required quantity of solvent for a given viscosity varies with the particular solvent used. Instead of stirring the solution with water it may be treated with steam, which may be supplied to the solution in a manner similar to that in which air is used in nitrating vessels. When steam is used the viscosity of the solution should be slightly greater, because of the increase in temperature. Relatively less solvent may be used in this case. A suitable moderant, such as vaseline, may be used; or the powder may be gelatinised on its surface; or it may be coated with graphite in the usual way. Accepted June 8, 1905.

MODIFIED EXPLOSIVES CONTAINING ALUMINIUM.

6,651 (1905). H. J. Haddon, London (Agent for *G. Roth, Austria*). In Patents Nos. 16,277, 1900, and 3,253 and 4,699, 1904, explosive mixtures containing aluminium have been dealt with. In the first named it is stated that the explosives described can be fully exploded only by powerful preparations of fulminate of mercury. The object of the patentees is to devise less dangerous means of detonating such explosives.

They have discovered that these explosives can be fully exploded by means of gunpowder, provided they are enclosed in very strong shells or in strong fuse cases enclosed in the shells; and provided that the explosives are mixed with suitable materials adapted to act as high pressure exciters in order to procure the gasification of the explosives. An example of a mixture to be added to the explosives for this purpose is as follows:—one part of sulphur, 4·5 parts of peroxide of lead, 2·5 parts of carbon, and 5·5 parts of potassium nitrate. These constituents are finely pulverised and are intimately mixed in a mixing drum. They are then added to the explosive, which may, for instance, contain:—45 per cent. nitrate of ammonia, 19·5 per cent. di-nitrotoluol or tri-nitrotoluol, and 22 per cent. aluminium.

The composition formed by the explosive and the admixture set out may be pressed, granulated, or used in pulverised form. For charging shells, it should be used in the granulated form, but for fuses, the pulverised form is better. In either case gunpowder will effect ignition. The composition is placed in a tube, one end of which is closed. The other end receives a gunpowder fuse. The tube with the fuse is inserted into the shell containing the explosive. The fuse is then adapted to fulfil the same function as the detonators had hitherto. Accepted June 15, 1905.

DUPLEX SINGLE-TRIGGER MECHANISM.

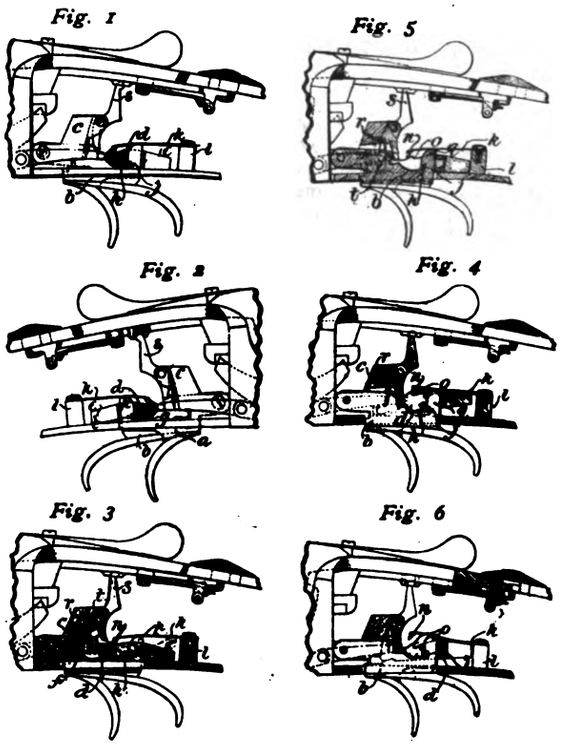
20,208 (1904). J. Carter, Birmingham. A construction of lock mechanism, having two distinct triggers, each of which is capable of lifting in succession both sears of a double-barrelled gun, is fully described and illustrated in this specification. By pulling the right-hand trigger, the two barrels may be discharged in the "right-first-and-then-left" order; or by operating the left-hand trigger the barrels may be discharged left first and then right; or the gun may be used in the same manner as a two-triggered double-barrelled gun of usual construction.

Our readers should turn to the patent specification in order to refer to the several modifications of the mechanism set out in the patent, as in the limited space at our command, we can give only a review of the principle of the system. In the appended drawings, Fig. 1 represents an elevation of the mechanism in the position it assumes when cocked and ready for firing, but before the "safety" is removed. Fig. 2 shows the parts in the same position as seen from the reverse, or the right-hand side. Fig. 3 is a left-hand sectional elevation, intended more clearly to illustrate the disposition of the "clutch" or trigger coupling, which locks the triggers together after the first discharge, and which is also the obviator of the involuntary pull. The clutch, in the position shown in this illustration, is in the one it is caused to occupy by the recoil set up by the first discharge. Fig. 4 shows the parts in the positions in which they are placed when the left-hand trigger is pulled first, just before the sear nose leaves bent; and Fig. 5 gives an idea of the positions of the parts when under influence of recoil after the first discharge. Fig. 6 illustrates the arrangement of the parts when the triggers have been coupled, and are lifted in unison by the pulling of one or other of them for the discharge of the second barrel.

The triggers *a* and *b* are pivoted to the lump *c* in the ordinary way, and the sear-tails lie along the top edges of the blades in the usual positions. Located within the space between the trigger-blades is a coupling device or clutch-slide *d*, which is capable both of a sliding and of a rocking motion. It is not positively connected with any other part of the mechanism, and is therefore, adapted to change its position relatively to the other parts when the gun rebounds under the influence of recoil. To augment the inertia of this loose clutch-plate *d*, its after end is weighted as at *e*. Its forward end has a rounded head *f*, which engages within a slot in the base of the lump *c*. On either side, the plate is provided with studs *g* and *h*, adapted to engage respectively with gaps or locking notches *i* and *j*, cut in the rear ends of the trigger blades. When slots and studs are in engagement the triggers are coupled, and when one is pulled both are raised. Normally, the plate is maintained in a forward position (Figs. 1, 2 and 3), and only after the effects of the involuntary pull have been neutralised is the clutch-plate *d* caused to couple up the triggers ready for second discharge.

The slide *d* is held in the forward position by an interceptor *k*, consisting of a flat spring of sufficient width to overlap both the clutch slide and both trigger blades. It is mounted on the summit of the fixed post *l*. Its free end carries a tooth *n*, which is adapted to engage with the notch or stop shoulder *o*, cut in the top of the clutch-slide *d*. The stop shoulder *o* is slightly undercut, so that when the spring is lifted by either of the upstanding ends *p q* of the trigger blades, the tooth *n* raises the clutch plate with it, and thus takes the studs *i* and *h* out of their normal alignment with the corresponding locking notches *i* and *j* in the trigger blades. The interceptor also holds the clutch slide in its forward position, in opposition to the pressure of the light spring *p*, which bears against the front edge of the slide. This spring *r* offers no obstacle to the relative displacement of the plate when the gun recoils, although, when the slide is freed, it forces its studs *j* and *h* to engage with the locking notches in the triggers.

When the parts are in position illustrated in Figs. 1 and 2, the gun is cocked ready for discharging either or both barrels. The safety slide must first be actuated to remove the swinging leg *s* from the locking hold it has on the trigger tops. Then assuming that the shooter desires to discharge the left-hand barrel first, the left-hand trigger is pulled, and the object is achieved. When the trigger blade is raised during this operation, its upright end *q* lifts also the interceptor spring *k*, raising it to the position shown in Fig. 4. This lifting movement causes the tooth *n* to impart an upward angular motion to the clutch-plate *n* before the actual discharge takes place. The studs *g* and *h* are, by this means, as has been explained, taking out of alignment with the locking recesses *i* and *j*. The discharge occurring, the recoil is caused to throw the whole of the gun against the shoulder minus the clutch slide which, by reason of being entirely disconnected, and its inertia helped by the weight *e*, at its after end makes a relative forward movement. Instead,



therefore, of being forced back by the light spring *r*, the clutch slide is caught and held in the same position as it occupied before the left-hand trigger was pulled (Fig. 3). The forward rebound brings about a second pull, this time an involuntary one, and the tooth *n* and shoulder *o* being thus again disengaged, the spring *r* is allowed to force the clutch plate backwards, and the studs *g* and *h* are carried into locking engagement with the slots *i* and *j*. Herein the studs are retained partly by the spring *r* and partly by the interceptor tooth *n*, which bears upon the incline forward of the shoulder *o* (Fig. 5). The two triggers are thus coupled together (Fig. 6), and when the left-hand trigger is again pulled, both triggers are raised, and the right-hand barrel is discharged. When the gun is opened for reloading the movement of the safety bolt impinges against the resetting shoulder *t* and brings the parts into the position shown in Figs. 1 and 2. Accepted June 29, 1905.

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CURRENT TOPICS.

Sporting Prospects.—The general impression to be gained from reports arriving from different parts of the country is that the shooting season, now upon us, will show a fair head of game of all kinds. Although we hear the usual references to injurious storms during the breeding season one has a difficulty in calling to mind the particular inclement weather referred to. Game birds of all kinds necessarily suffer from the June storms, but the large size of the coveys reported from various parts of the country go to show that if such weather did exist its effects were not uniformly distributed. So far, therefore, as the commercial results of the season's shooting can be foreseen there appears to be sufficient prospect of plenty of shooting, and experience shows that whether the times are good or bad somebody will go after the game. Bad business for the trade is mostly reflected in a lack of orders for new guns. When times are good and stockbrokers, barristers and kings of commerce generally become tenants of large shoots orders for new guns follow as a natural consequence. When on the other hand shootings are not letting well, and those who take them at a knock-down price, intending to shoot down the game without spending money on its preservation, then the finest rearing season fails to show the necessary returns on the books of the gunmaker. More than this the lower the class of shooting tenant the more likely is he to stint money in the purchase of equipment. For the time at any rate the best class of sportsman is anxiously waiting for a season when money conditions will be sufficiently favourable to enable him to do things as he feels they ought to be done. Meanwhile, though the game that is there will always be shot, the benefit to the trade is reduced to a minimum, and this unfortunate condition of affairs has been with us for some years, there being for the moment but slight indications of improvement.

Explosives Inspectors on Tour.—Many times in the year we feel called upon to refer with pleasurable appreciation to the strenuous efforts of our explosives inspectors to keep pace with the requirements of their difficult position. Last month we had before us their annual report and a new and improved edition of the guide book to the Act. This month our attention is directed to two other deeds of almost equal merit. The first is the issue of the report covering a tour over Continental factories and testing stations by two of the inspectors. The other is the issue of an elementary primer for the use of local inspectors and dealers in explosives. In regard to the first matter it will be understood that the facilities which have been accorded to Captains Lloyd and Desborough would probably never have been granted to persons in a private or trade position. The exceptional character of the knowledge which is garnered by officials having the *entrée* to the jealously guarded secrets of the explosives factories must of necessity be used for publication purposes with care and discrimination. Even then the residue of information which may be served up for public use must possess exceptional value by reason of the knowledge which lies behind. In spite of the temptation to make undue use of the facts so gathered we never remember hearing of complaints in this connection. Our own manufacturers must trust the inspectors whether they like it or not; but when we find that an equal measure of confidence is voluntarily

bestowed by foreign firms enjoying perfect liberty of action we must recognise that the culminating proof of our inspectors' tact and reserve has been reached. The facts and views which are reproduced in the recently issued report will be read with interest by all concerned in the manufacture of explosives, and we commend it to the attention of our readers. In our review of Major Cooper-Key's primer of explosives we have expressed in the conventional form our appreciation of a useful and self-allotted task well performed.

The Small Arms Committee—The report to the effect that the old Small Arms Committee has been abolished, and that a new one is in process of formation, gives us good reason for hoping that during the course of the next few years we may be able, as a nation, to remedy most of the more obvious defects of our small arms equipment. Considering what an exceptional number of persons there are in this country well informed in the practical essentials of military and target rifle shooting, in the care and handling of arms under service conditions, and in the mechanical principles that underlie their design and manufacture, it is extraordinary that we should have made so little progress in putting this knowledge to a practical use. In almost every street, certainly in every village and suburb, we have troopers, armourer-sergeants and marksmen of exceptional knowledge, who prove to be veritable mines of information concerning the principles and details of military rifles as used under war conditions. This information seldom reaches the officer class, and it is so scattered as to be difficult to collect into consistent form. Even so the information is there for those who will take the trouble to seek it. It rests with the new Small Arms Committee to collect recent and practical information concerning the desirable points of a military magazine rifle, and to ascertain by what means these can be introduced into the weapon, while preserving its essential simplicity of form. The design of such a rifle should not be dominated by undue straining after perfection in any one direction. It would fully occupy one man's time to keep touch with all the details involved, and even then he should have the happy knack of drawing information from others and thereby increasing the scope of his own knowledge. A committee should act as a medium for collecting diverse views and experiences, and its discussions should be directed towards defining a clear course amidst overlapping opinions and recommendations. The best critic can only express his own views, whereas the decisions of a committee should represent a harmonising of diverse and sometimes contradictory notions. It will be exceedingly difficult in any case to arrange the personality of the new committee, so that its members may combine a knowledge of detail with the power to extract general principles therefrom.

Miniature Rifle Meetings.—The holding of a series of miniature rifle meetings by the Society of Miniature Rifle Clubs will doubtless bring much useful experience into the hands of the various officials concerned. To conduct such meetings at a minimum cost, to get through a comprehensive programme in a limited number of hours, and to make the rules of such meetings the controlling factor for the conditions of sport at other times, represent a task of considerable difficulty. It is, however, only by doing one's best on each occasion that order will be gradually evolved from the existing state of doubt and uncertainty. Shooting is at present being carried out in many parts of the country without any agreed standard of rifle or ammunition. There is every likelihood that shooting will ultimately produce the right kind of rifle with greater certainty than a perfect rifle could be expected to produce a widespread desire to shoot it. A desire to excel will cause the individual shooter to hunt up the available types of rifle and refit and alter them to his taste until he has evolved a type of weapon which others will copy. In due course the various manufacturers will compete to meet the demand, and it will not be long before the tyro gets exactly what he needs. At the present moment the manufacturer must be very much master of his business to decide from a multitude of counsels exactly the type of rifle which will best suit the ever changing requirements of the miniature club marksman. In a pamphlet issued by the Society of Miniature Rifle Clubs, the Winchester ·22 magazine rifle was recommended as the most suitable weapon for club practice. At the time we entirely disagreed with this dictum, and observations at the Olympia meeting confirmed this view. Nowadays we seldom see a magazine rifle in use at a miniature club where a high standard of shooting has been attained, and single-shot weapons are more used than ever before for rabbits and small game shooting where the magazine has distinct features of merit. With the lessons of so frequent a change of view before us, it is clear that the manufacturer must go warily to work if he intends to avoid wastage of stock in his efforts to supply the needs of the moment.

Clay Bird Practice.—The shooting school may be regarded as quite the most satisfactory latter day development in the gun trade. Whether the gun fitting business is active or not each day seems to bring its well-filled list of appointments. The ungainly shot who practices on moor or stubble to the danger of his friends is becoming rarer and rarer, so that the writers of our sporting volumes must soon discover some fresh victim for their jokes and satires. The shooting school can teach a man more about shooting deportment and the proper handling of his gun in the course of a series of one-hour visits than he can pick up in the entire course of the casual invitations which a shooting season may produce. The natural desire to acquire one's experience out of sight of unsympathetic onlookers affords the necessary inducement to the recipient of an invitation to take suitable measures beforehand to eliminate his grosser faults and misconceptions. The shooter with a reputation to uphold derives great benefit from a course of preliminary practice suited to his own special requirements. That clay bird practice has many votaries is evidenced by the ever increasing number of the charactistic wooden towers which are now such prominent landmarks around the outskirts of London. These towers denote the presence of shooting schools with a more or less comprehensive equipment of apparatus, and there are very few of them which suffer from lack of patronage. Coincident with the developments of the shooting school, the skill of the professional coach is growing apace. He is versed in a new branch of gun technics, that is the balance of the gun as a whole and the formation of the stock with reference to the build and idiosyncrasies of the tutor.

THE OFFICIAL ORGAN OF THE NATIONAL RIFLE ASSOCIATION.

THE *Bull's-eye* is the name of a paper which is mainly devoted to the interests of civilian rifle clubs. It is also described on the front cover as the official organ of the National Rifle Association. It is not for us to discuss the exact nature of the relations which bind the *Bull's-eye* to the National Rifle Association, thereby entitling it to make use of the above description. The English national temperament is to hold the most pessimistic views about one's individual doings. With the finest navy in the world, we are always foretelling disaster, should it ever be put to a practical test. With an extensive system of commerce which embraces the whole universe, our favourite reading is statistics showing its gradual decline. While probably more devoted to athletics than any country, our chief anxiety is the physical deterioration of the race. In like manner the official organ of the National Rifle Association seems mainly to occupy its attention with criticisms of the policy of the parent concern and attacks upon the capacity of its officials. The most recently received number contains a letter signed "Progress," which goes but a very little further than editorial effusions of a previous date. So far as we can judge, the gentleman who adopts so flattering a keynote for his own policy is the kind of reformer who would like to pull the entire world to pieces with a view to rebuilding it on sensible lines. The following extract from his letter, which is entitled "A Cry for Reform," affords a sufficient index to his views:—

"The antique organisation of the N.R.A., devised at a period when it was conceived that any national movement might be best encouraged by means of an association of influential personages, without the usual machinery necessary to the conduct of business, has in forty-five years undergone little or no change, and is, in consequence unsuited to the present time. The rise and development of the civilian rifle club movement seems quite beyond the appreciation of the military element composing its council, and, judging from the attitude assumed towards it so far, it would seem that the N.R.A. conceives that its duty begins and ends at receiving the affiliation fees. The task of regenerating the N.R.A. is so unpromising as not to justify the attempt, but the newer organisation, The Society of Miniature Rifle Clubs, has so far exhibited such signs of progressive existence that the clubs might do worse than co-operate with it in the hope of creating a live organisation which might reduce the present chaotic uncertainty into some order and uniformity."

The writer then proceeds to develop certain ideas on the sighting of rifles, and the editor duly adds a footnote disagreeing with the views put forward. The subject of sights for military rifle shooting and miniature practice is one in which there is every justification for differences of opinion. No exception need accordingly be taken to the statement of views on so difficult a subject, whatever may be the policy that is upheld Although *we* are not in any sense the official organ of the National Rifle Association, we can at least claim to know enough about its personality and its organisation to discuss some of the chief points in the above attack. To our way of thinking the National Rifle Association, so far from being an antique organisation out of touch with present-day methods, is one of the most efficient public bodies in existence. It is without question the largest organisation in the world for the encouragement of military rifle shooting. It sets the fashion to the whole of our colonies and dependencies, and it is upon the model of the National Rifle Association that United States riflemen are endeavouring to encourage rifle shooting of a military useful character. As regards administration its annual turnover well exceeds £20,000, and we do not believe that a single sixpence of this amount is carelessly spent or in any sense of the word appropriated to wrong purposes. The executive staff is controlled by a body of gentlemen who are known as the Council. We may sneer at them as military element, but such sneers are not only unjust but in bad taste. Every member of the Council is a man of proved worth and high position in the rifle shooting world, and although most of them hold military titles the large proportion are volunteer officers whose ordinary occupations in life certify the existence of administrative capacity and business knowledge. When to these are added an altogether unique experience in the drafting of rules, a knowledge of human nature as exemplified in shooting contests, and a loyalty to just traditions of fairness and independence, it is clear that the Council of our National Rifle Association would take a deal of beating when judged by the only true test, that of capacity to perform its allotted task. In reviewing actual accomplishments we must give the National Rifle Association full credit for having relaxed the rigours of the Gun Licence Act in favour of club shooters. It has also administered the Astor Trust Fund in an exemplary fashion, and it has been concerned in two important annual miniature meetings. which have in each instance been voted an unqualified success. The present needs are limited to the production of comprehensive rules determining the conditions of shooting and the organisation of an annual prize meeting within easy reach of town. These requirements should easily be met by a body already possessing the requisite authority and organization.

It is not genius to see the failings of an existing structure. To pull down and rebuild with a full knowledge of previous experience would merely produce a fresh fabric having a fresh set of defects. The National Rifle Association may fall short of perfection in many respects; but we can endure these small temporary disadvantages in the full knowledge that the responsible officials are fully aware of the need for extension and are only postponing the necessary modifications while the details are under consideration. On the subject of club rifle shooting of the miniature kind the Council have clearly failed to take measures adequately proportioned to the importance of the new development. They are quite as much aware of this fact as any outsider, but the difference is that they appreciate the difficulties of the position and desire to act cautiously, whereas the outsider might do more harm than good by perpetrating a host of well-meant blunders. Our confidence that the National Rifle Association will in the end do the right thing for the clubs is wholly based upon the knowledge that the Council of that body is entirely composed of members working in perfect harmony together and having no private ambitions to deflect them from the plain course of duty. No one would regret more than ourselves the day when an adverse and hostile element was incorporated into the Council under the guise of making it a representative body. The complete understanding which exists amongst its members is the best possible guarantee of efficient methods, and we do not believe that civilian rifle shooting has yet brought to the front any individual free from faddist notions and capable of taking a broad-minded view of the needs of the situation.

A PRIMER OF EXPLOSIVES.

IT would be a bold man who would assert that any one book is the best of its kind. Yet there is nothing but this feeling of caution to prevent applying such eulogy to the little work, entitled as above, which has been written by Major A. Cooper-Key, edited by Capt. J. H. Thomson and published in neat cloth cover form by Messrs. Macmillan. A well-known difficulty which is felt more particularly by scientific men of the highest standing is to present their ideas in a manner suited for perusal by the general reader. It has been said by some of our most experienced writers that the best philosopher and guide in any art or scientific study is the man who has recently covered the ground on his own account. Anyone so placed has in clear perspective the difficulties which assailed him when in the open-mind condition. The course of tuition he has pursued will enable him to tell the reader what the reader wishes to know without digging too deeply by way of illustrating arguments or elaborating simple statements of fact. This line of reasoning seems to show why H.M. Inspectors of Explosives are able with such signal success to clear up in their reports and general writings the technicalities of a difficult subject. Being highly educated men in the first place, and having altogether exceptional facilities for acquiring information of the right kind it is not long before they are well equipped for the task. The greatest praise we can accord to Major Cooper-Key's little shilling 94-page work is to quote the following incidental passages taken at random from the text not only as models of how such ideas should be expressed, but as samples of the uniform level of success to which he has attained :—

Necessity for granting Gunpowder special privileges.—At first sight it may not appear to be a matter of much importance whether gunpowder belongs to the first or to the second class but there is more in this matter than meets the eye. At the time the Explosives Bill was under discussion there were already in existence several Acts of Parliament dealing with explosives. Into the merits and defects of these it is not necessary to enter, but that there were deficiencies of such a nature as to justify fresh legislation may be taken for granted. The trade in gunpowder "ordinarily so called" was then solely governed by the Gunpowder Act, 1860, and not only was that Act remarkably innocent of any undue regard for the safety of the public, but such simple precautions as were enjoined could not be effectively enforced on account of the very limited powers of inspection. This comparative immunity from restriction was presumably deemed to constitute a kind of vested interest, which was acknowledged in the present Act by dealing with gunpowder separately from all other explosives. Consequently, although from the point of view of safety there may be no material difference between this explosive and other nitrate mixtures, it must for the sake of convenience be placed in a class by itself.

Points of an Ammonium-Nitrate Explosive.—The good points of the ammonium-nitrate group of explosives are :—

(1) Simplicity and safety in manufacture.

(2) So far as past experience goes, they seem to be considerably less dangerous to handle and store than most other explosives.

(3) They do not freeze.

(4) They are not, as a rule, easily ignited by the direct application of fire, and when ignited there is no record of an explosion having resulted, unless a detonator is present.

(5) If they are kept too long or the cartridges subjected to rough handling, the affinity of the nitrate for moisture soon renders the explosives harmless. Moreover, there is practically no danger in throwing these explosives away, provided the cartridge cases are opened and the weather is not too dry.

(6) They are, as a class, relatively safe to use in "fiery" mines. The bad points are :—

(1) To get the best results they require a large detonator,—itself a source of danger.

(2) Slight defects of manufacture or the access of a very little moisture may cause misfires or only partial detonation, or may even render the explosive entirely useless.

(3) The cartridges do not adapt themselves well to the shape of an irregular bore-hole.

Collodion Cotton.—Without going into the somewhat vexed question of the exact chemical constitution of the gun-cotton molecule, it may not be amiss to point out that the stronger the acids used the higher will be the degree of nitration and consequent percentage of nitrogen in the finished product, and that when this percentage falls to 12·3 the material is known as collodion cotton, and when wet is not then regarded as an explosive. In the dry state, however, serious explosions of collodion cotton have been recorded, its difference from gun-cotton being merely one of degree, and even the very moderately nitrated material used in the manufacture of celluloid, and which as a rule contains less than 11 per cent. of nitrogen, has recently given evidences of considerable explosive power.

Requirements of a good Sporting powder.—The requirements of a good sporting powder are :—

(1) It should be stable and should keep well under ordinary conditions. This depends largely on the purity of the ingredients and particularly on that of the nitrocellulose.

(2) It should be regular in its shooting, *i.e.*, the pressure, muzzle velocity, and "pattern" should not vary beyond certain limits.

(3) The smoke and unconsumed residue should not be noticeable.

(4) The recoil and report should be reduced to a minimum. During one of the big covert shoots of the present day, or in a day's grouse or partridge driving, the cartridges fired by each gun of a party will probably amount to many hundreds, and the quality of the blow dealt by each on the shoulder and the ear-drum may make all the difference between enjoyment and the reverse.

(5) It should be well adapted to the cap with which it is intended to be used, otherwise slight hang-fires may result, and nothing is more irritating to a shooter.

(6) It should not call for any special skill on the part of the cartridge loader.

Safety Cartridges.—Although the number of safety cartridges kept together in one place may not materially increase the danger,—which is at worst exceedingly remote,—the presence of bulk explosive in the vicinity entirely alters the case, and it is therefore of the first importance that safety cartridges, capped cartridge-cases and percussion-caps should be kept at such a distance from the bulk explosive, or separated from it by so substantial a partition, that the accidential explosion of a cap, whether or not in a cartridge, cannot possibly communicate to the other explosive.

THE NEW TRADE MARKS ACT.

So many of our Acts of Parliament have attained a hopeless muddle by reason of modifying acts and a whole host of court decisions on interpretation of clauses, to say nothing of subsidiary orders in council, that we welcome the policy of a consolidating act which gives us a fresh start. Our most brilliant patent law expert—Mr. Fletcher Moulton, K.C., M.P., F.R.S.—has had many opportunities, during a distinguished career at the bar, of studying the anomalies and inadequate rules that govern the daily practice in trade mark registration. The gratitude of the whole business community has been earned by the herculean task he undertook when he decided to codify the present trade marks law and incorporate into it several much needed amendments. Parliament, which has lately earned the reputation of being a useless organisation incapable of performing useful services, also merits our regard, by having allowed Mr. Moulton's Bill to pass into law without opposition.

Among the definitions we read that:—A "trade mark" shall mean a mark used or proposed to be used upon or in connection with goods for the purpose of indicating that they are the goods of the proprietor of such trade mark by virtue of manufacture, selection, certification, dealing with, or offering for sale. Clause 9 states that a registrable trade mark must consist of at least one of various essential particulars, and due regard is given to "distinctive marks," surnames and words not being, according to ordinary signification, a geographical name. The distinctiveness of a trade mark with reference to the colour in which it is reproduced is duly dealt with in the next clause. Under the heading of disclaimers, Clause 15 lays down that:—"If a trade mark contains parts not separately registered by the proprietor as trade marks, or if it contains matter common to the trade or otherwise of a non-distinctive character, the Registrar or the Board of Trade or the Court, in deciding whether such trade mark shall be entered or shall remain upon the register, may require, as a condition of its being upon the register, that the proprietor shall disclaim any right to the exclusive use of any part or parts of such trade mark, or of all or any portion of such matter, to the exclusive use of which they hold him not to be entitled, or that he shall make such other disclaimer as they may consider needful for the purpose of defining his rights under such registration: Provided always that no disclaimer upon the register shall affect any rights of the proprietor of a trade mark except such as arise out of the registration of the trade mark in respect of which the disclaimer is made."

There are in existence a considerable number of registered trade marks which embarrass the choice of persons desiring to select a suitable name without being in use by the owners thereof. Clause 37 sets this anomaly in order in the following terms:—"A registered trade mark may, on the application to the court of any person aggrieved, be taken off the register in respect of any of the goods for which it is registered, on the ground that it was registered by the proprietor or a predecessor in title without any bonâ fide intention to use the same in connection with such goods, and there has in fact been no bonâ fide user of the same in connection therewith, or on the ground that there has been no bonâ fide user of such trade mark in connection with such goods during the five years immediately preceding the application, unless in either case such non-user is shown to be due to special circumstances in the trade, and not to any intention not to use or to abandon such trade mark in respect of such goods"

On the subject of infringement it is precisely laid down that in an action for the infringement of a trade mark the court shall admit evidence of the usages of the trade in respect to the get-up of the goods for which the trade mark is registered, and if any trade marks or get-up immediately used in connection with such goods by other persons. It is also enjoined that no registration under the act shall interfere with the bonâ fide use by a person of his own name or place of business, or the use by any person of any bonâ fide description of the character or quality of his goods. Nothing in the act can however be deemed to effect rights of action against any person for passing off goods as those of another person.

Among gunmakers it will come as welcome news that a specific clause has been incorporated into the new Act for preventing the unauthorised assumption of Royal Arms. The actual wording of Clause 68 stands as follows:—

"If any person, without the authority of His Majesty, uses in connection with any trade, business, calling, or profession, the Royal Arms (or arms so closely resembling the same as to be calculated to deceive) in such manner as to be calculated to lead to the belief that he is duly authorised so to use the Royal Arms, or if any person without the authority of His Majesty or a member of the Royal Family, uses in connection with any trade, business, calling, or profession any device, emblem, or title in such a manner as to be calculated to lead to the belief that he is employed by or supplies goods to His Majesty or such member of the Royal Family, he may, at the suit of any person who is authorised to use such arms or such device, emblem, or title, or is authorised by the Lord Chamberlain to take proceedings in that behalf, be restrained by injunction or interdict from continuing so to use the same: Provided that nothing in this section shall be construed as affecting the right, if any, of the proprietor of a trade mark containing any such arms, device, emblem, or title to continue to use such trade mark."

The permanency of a trade mark, regarded as an asset in business, is very clearly laid down in Clause 41, which states that:—"In all legal proceedings relating to a registered mark, the original registration of such trade mark shall, after the expiration of seven years from the date of such original registration (or seven years from the passing of this Act whichever shall last happen) be taken to be valid in all respects unless such original registration was obtained by fraud, or unless the trade mark offends against the provisions of Section 11 of this Act." This last mentioned clause merely prohibits the registration of trade marks of a deceptive or otherwise objectionable character. The full wording is as follows:—"It shall not be lawful to register as a trade mark or part of a trade mark any matter, the use of which would by reason of its being calculated to deceive or otherwise be disentitled to projection in a court of justice, or would be contrary to law or morality, or any scandalous design."

The Act will be known as the Trades Marks Act, 1905. It will come into force on April 1st next year, and it repeals those portions of the Patents, Designs, and Trade Marks Acts of 1883 and 1888 respectively which are concerned with trade marks.

CONTINENTAL DOINGS.

Dry Battery for Firing Mine Shots.—A note in this column for July stated that a dry battery was used at the Drocourt Colliery for firing mine shots, which gave good results. A valued correspondent, who is anxious to obtain "a reliable dry cell battery," wrote asking for the address. In reply to a personal request the manager of the colliery confirmed his approval of the battery, and gave the address of the Paris agents. The query was passed thence to the parent company, who replied through the *Compagnie Belge d'Electricité Siemens-Schuckert*, stating that the Helesen dry battery, 76 mm. by 76 mm. and 182 mm. high (3 in. by 3 in. by 7¼ in.), is stocked at Brussels.

Belgian Safety Explosives.—No less than twenty-one explosives were credited with the denomination of "safety" in application of the Ministerial Circular of 27th October, 1900; but the first experiments made at the Government testing station, Frameries, showed that, if these explosives were the best from this point of view hitherto employed in Belgium, very few of them really deserved their qualification. The mining industry was, was, however, soon endowed with explosives of greater safety. This was rendered possible, on the one hand, by modifications in composition and manufacture suggested by the Government tests, and on the other by the adoption of certain foreign explosives which had shown good results on being tested.

The Belgian Government Tests.—These have hitherto consisted in determining (1) the "limit" charge, without tamping, of the explosives formerly classed as safety and of some newly introduced; (2) the "extreme" safety charge, with tamping, of some of the above; and (3) the power of the explosives. The samples submitted for test, accompanied by a declaration of composition, were analysed by way of check, which only in one case showed an appreciable difference. The density of loading was shown to exert appreciable influence on the value of the limit charge, the degree of safety diminishing with increase in the density. The limit charge was determined by ten tests failing to ignite fire-damp mixtures. Ignition was first produced; and then the charge was gradually reduced by 50 grammes (1⅞ oz.) for charges higher than 200 grammes (6¾ oz.) and half that quantity for charges below it.

Determining the Explosive Force.—The power of the explosives was measured by the lead block test; and the standard was constituted by 10 grammes (⅓ oz.) of dynamite with 75 per cent. of nitroglycerine, chosen on account of the simplicity and constancy of its composition. The tamping was effected with 20 cu. cm. (1¼ cu. in.) of fine dry sand (for protecting explosives containing hygroscopic salts) followed by clay slightly damped above, and closed by an iron plate with wooden wedges. The weights of explosives tested, corresponding with the standard, varied between 9·65 and 22·6 grammes (30 grammes = 1 oz.); but the equivalent weights of most of the various safety explosives are comprised between 16 and 19 grammes. The limit charge being known and the equivalent weight determined, it is easy to arrive at the charge of standard explosive corresponding with the limit charge of each explosive substance. Such knowledge is evidently what is most interesting, because it is this charge which gives the safety explosive its true value.

Comparative Disruptive Effect.—The above particulars as to Belgian safety explosives are culled from a paper read before the International Mining Congress, held in connection with the Liége Exhibition, by M. V. Watteyne, *Ingénieur en chef des Mines*, and M. S. Stassart, *Ingénieur des Mines*, who considered that it would be useful and interesting to know the quantity of rock that can be brought down by the "limit charge" and the "maximum charge" of the explosives tested. The limit charge is defined above; and the maximum charge is the limit charge increased by 200 grammes, but without tamping. A graphic diagram was presented to the Congress, showing the comparative volume of rock brought down by the "limit" and the "maximum" charges of the eleven explosives; and this is illustrated at the Exhibition in a more telling manner by full-size cubes, showing the quantity of rock displaced by the maximum charge. For determining the comparative quantities, experimental blasts were made with grisoutite, with which it was found that, in rock offering great resistance, charges of 300, 400 and 500 grammes brought down about 0·75, 1 and 1·75 cubic metres of rock respectively. (30 grammes = 1 oz. and 1 cu. m. = 36 cu. ft.).

L'Armurerie Liégeoise.—This is the title of an 8vo. brochure, containing about 100 pages, by M. Jules Polain, engineer and barrister, manager of the Liége Proof-house, and Belgian Government Commissioner charged with the supervision of firearms in the Kingdom, published by Vaillant-Carmanne, Liége. The work begins with a history of the Liége arms manufacture, and reproduces the graphic diagram showing its progress, referred to in a note last month. Of the twenty-six various operations into which firearms manufacture is divided, only the making of barrels is described in the present volume, because the others have already been dealt with in a previous work, published by the author in 1893, entitled "La division du travail dans l'Armurerie Liégoise." Work at home and also in engine-driven workshops is discussed, as also the organisation, regulation and results of the Technical School of Armoury, founded in 1897 by the Liége armourers. The question is raised whether the proving of firearms should be optional or compulsory; and the author brings forward a host of reasons in favour of the latter. The remaining pages are occupied by a description of the Liége Banc d'Epreuves, or Proof House.

Technical School of Armoury.—The Liége Gunmakers' School, which originated with eight pupils in 1896, and was endowed with a government grant in the following year, for theoretical instruction in the making of arms, has been so successful that the original premises, though enlarged from time to time, were found inadequate to accommodate the ever increasing number of pupils. Accordingly, a new and appropriate building has been erected, on the first floor of which are the class-rooms for pupils of the first, second and third years. On the second floor are the drawing office and four sections, comprising the *équipeurs*, *monteurs à bois*, *platineurs et systémeurs*. The new school was opened on 29th July by Prince Albert of Belgium, who was received by M. Charles Francotte, president of the Administrative Council; M. Dumany, vice-president; M. Polain, representing the Belgian Government, and M. Dumoulin, president of the Arms Museum In his reply to the address of welcome, the Prince said he was greatly interested in the Liége arms industry, which he was convinced would maintain its ancient reputation.

ROUND THE TRADE.

We regret to hear of the death of Mr. E. F. Quilter, a director of the firm of Eley Brothers.

The firm of Holland & Holland are now advertising their "New Magnum Paradox" rifle giving higher ballistics than the older pattern and sighted up to 300 yds.

The report by Capts. Lloyd and Desborough, as quoted in another column, is published at threepence, and can be obtained from Messrs. Wyman & Sons of Fetter Lane.

Cassell's Magazine for the current month contains an illustrated article on the West London Shooting School, describing in popular language the educational process of training the shooter.

We have received from Messrs. Charles Osborne the catalogue they issue to the trade only, describing their series of standard guns and rifles, of which immediate delivery can be effected.

Messrs. Curtis's & Harvey have issued their new "Featherweight" cartridge, which is specially adapted to shoot a light load, viz. $\frac{7}{8}$ths of an ounce. It is put forward as a means of preventing gun-headache.

We are informed that Mr. P. W. Thornbery has been appointed manager of the Army and Navy Stores gun department at Calcutta. Mr. Thornbery has hitherto been with Messrs. W. J. Jeffery & Co., of 60, Queen Victoria Street, E.C.

The Manufacture Française d'Armes et Cycles have forwarded to this office a copy of their comprehensive catalogue of guns, revolvers and accessories. Although the firm are large manufacturers the catalogue shows that their Paris depot is stocked with a variety of goods on the lines of the firm of Gamage in London.

The attention of the trade should be directed at this time to the provision contained in the Order in Council (No. 7) of June 10 last year which came into force on January 1 to the effect that consignments of safety cartridges must be branded with the words :—"not liable to explode in bulk." See page 230 in the new *Guide to the Explosives Act, 1875*.

The authorities at the War Office have issued the following announcement for publication :—"The question of the pattern of miniature rifle best suited for shooting on miniature ranges and for drill purposes, in the case of cadets and lads, was recently considered by a conference held at the War Office, at which the National Rifle Association and the Miniature Rifle Clubs were represented, and it was decided to prepare designs with a view to the adoption of a standard pattern."

The issue of the *Journal of the United Service Institution* dated August 15th last contains the full text of Major the Hon. T. F. Fremantle's lecture on "Modern Military Rifles," which was delivered on the 28th March last. Including the report of the subsequent discussion it occupies 32 pages of closely printed type. The cost of the journal is 2s., and everybody interested in the subject matter of the lecturer's remarks should make a point of obtaining a copy at once to avoid any risk of supplies running short.

The Gamage catalogue for the 1905 season shows that the Company's Referee cartridge, which is loaded with a nominal charge of shot and smokeless powder to give the same results as Schultze, E.C. and other well-known powders can be obtained at 60s. per thousand carriage paid, or in hundred lots at 7s. also carriage paid. It is a little difficult to understand how the firm is able, except at a disproportionate cost, to send a free sample of five cartridges neatly packed in a card box and carriage paid for the benefit of prospective customers.

The American papers give notice of the issue of an enlarged model of the Winchester automatic rifle. The first pattern it will be remembered was adapted for a special ·22 rim-fire cartridge designated the ·22 automatic. The new 1905 model carries the supply of ammunition in a box magazine beneath the receiver. The weapon has been adapted for two rimless central-fire cartridges of ·32 and ·35 calibre respectively. The ·32 cartridge contains a 165-grain soft-point metal-jacketted bullet giving a velocity of 1,400 ft. per second. The ·35 cartridge has a 180-grain bullet which is projected at the same velocity.

We have received from Mr. W. F. Brant a sample of the Tunstall and Brant windgauge attachment for fitting to the leaf of the Lee-Enfield Service Rifle. This device is already well-known in the trade and will be found exceptionally serviceable for use in rifles fitted with Morris tubes, or in which adapters are employed. The fixed sighting of the service rifle is notoriously wrong in adjustment for miniature ammunition. This is due partly to the fact that the sights of the service weapon are adjusted to correct the side flip and drift of the full-power cartridge, and also to the circumstance that no two rifles shoot alike.

The *Engineering News* of New York contains in its issue of August 3, 1905, a realistic illustration of a big blast involving 38 tons of dynamite at Henderson's Point, Portsmouth Harbour, U.S.A. The National Powder Company of New York made up the cartridges in plain paraffined paper sticks. These were 24 to 30 ins. long and in four sizes to fit the taper of the drill-hole, viz. $2\frac{1}{2}$, 3, $3\frac{1}{2}$ and 4 ins. diameter. The object of the blast was to clear away the rock underlying a cofferdam of horseshoe shape which has been erected to facilitate the removal by ordinary means of a 3-acre area of rock which stood at the entrance of some new docks.

The *Sporting Goods Dealer*, and possibly other American newspapers as well, contains an advertisement by the Marble Safety Axe Company of Gladstone, Mich, U.S.A., describing an automatic flexible joint rearsight. This has the external appearance of the well-known Lyman pattern, but is held in the upright position by an internal coiled spring which enables the stem to give way to the retracting bolt of a magazine rifle and resume a normal position when the breech is closed. The sight is fitted with a locking sleeve for holding it at any given adjustment. It will of course be understood that the Marble sight carries out the principle evolved some years ago by Mr. Baillie-Grohman in the sporting pattern of the Mannlicher-Schoenauer rifle.

Major Cooper-Key's report on the explosion of fireworks which occurred at Messrs. John Jennison & Company's factory at Belle Vue, near Manchester, on the 9th July last has just been issued. It appears that four men were filling a mixture of blue fire into little cardboard cylinders to form "lances," and that the material suddenly ignited. Major Cooper-Key's remarks concerning the sleeves of the woollen working costume are worthy of careful notice, and we accordingly reproduce them in full. The italics are our own, and we might add that the better class shooting jacket, with its wrist-band carrying two buttons affording two alternative degrees of tightness might be adapted for the purpose. "It is very difficult to persuade the British workman that it is possible to work without turning up the sleeves, and it is no doubt the natural inclination of anyone who desires to make a strenuous effort. In a corning house or other working building of a gunpowder factory where a spark means annihilation of everything in the immediate neighbourhood, this matter is not, perhaps, of great urgency, but in a building where the risk is chiefly one of fire and not of explosion, and where, therefore, it is possible that protection from fire may save life, this question becomes of the first importance. Much depends on the amount of skin area that is destroyed, and any provision that can reduce this is an advantage. In the present case Moss had both his sleeves rolled up and he was thus far more severely burnt than he would otherwise have been. If the British Bluejacket, the "handy-man" *par excellence*, can achieve apparent impossibilities with his sleeves tightly fastened round the wrist, why should it be found so difficult to charge a few fireworks without baring the arms to the elbow? Undoubtedly it is not easy to work with a loose flapping sleeve, but *if the serge overalls were fitted with tight wristbands* it is possible that the workpeople would be more able to resist the natural temptation to roll up their sleeves, and lives might consequently be saved."

VISIT TO CONTINENTAL EXPLOSIVE FACTORIES.

CAPTS. M. B. LLOYD and A. H. P. DESBOROUGH, H.M. Inspectors of Explosives, recently made a tour round a series of explosives factories and testing stations on the Continent. The results of their observations are presented in the form of a report to the Home Secretary, and the entire document is of such interest that we make no apology for reprinting it *in extenso*. The subject matter of the report is divided into two parts, Part 1 dealing with the factories visited.

BAELEN.

The factory of the Compagnie de la Forcite is about three-quarters of a mile from Baelin Usines Station, about one-and-a-half hours by train from Antwerp. In our visit to this factory we were accompanied by M. Guchez, the Belgian Inspector-General of Explosives. The factory is principally for the manufacture of nitroglycerine explosives, and imports explosives of this type into Great Britain. The factory is gradually being modernized, many of the older danger buildings being very much too close to one another and to the boiler-house and miscellaneous workshops of the factory.

The new buildings which are being erected are in accordance with what is to us a novel plan, devised by the manager of the factory, M. Pedersen. This consists of making the buildings circular in ground plan and lighting them entirely from the roof by means of a patent glass having wire-netting in it, and which, it is claimed, will not let a splinter fall even if it is very badly cracked. (A sample we saw appeared to bear out this contention). The mounds are then erected right up against the walls of the building and exceeding them in height by several metres, the inner face having its natural slope for such portion as is above the walls of the building and the outer slope having its natural slope throughout. For this method of construction it is claimed that the force exerted by an explosion will expand itself in a vertical direction; but, fortunately, the validity of this claim has not as yet been tested. There seem to be grounds for fearing that the vacuum action of an explosion so often noticed in buildings which are completely mounded, by which windows and sides are sucked outwards by the afterblast, may be specially damaging to the large circular roofs which this method of construction entails.

The quantities of glycerine nitrated at one operation are smaller than is usually the case in England, but this is partly counterbalanced by their allowing two or more charges to accumulate at a later stage of the operations. In only one of the houses were any rules or notices posted up for the instruction of the workpeople. A good system was adopted for skimming in the washing house. They use only the end of the rubber skimming pipe for the purpose, this being held in a flat stick furnished at one end with an oval hole in which the pipe is secured, and at the other with a wooden peg by means of which it is hung up when not in use. The factory being all on the level, they are not able to deal with the nitro-glycerine entirely by gravity; but convey it from one building to another in barrels slung from a trolley which runs on an overhead rail, and is worked by hand power. The system may have merits, in that there is no danger of nitroglycerine being spilt on the rail.

In the after-separating house, on the other hand, they perform y gravity an operation which in England is always done by hand. At the top of the separating house is a tank filled with waste acids which can be run at will into any of the separating flasks through a cock on a pipe leading into the body of the flask. An overflow is provided in the neck, and the separated nitroglycerine is thus removed by displacement in a manner similar to that of the new Waltham Abbey nitrators. The overflows were provided with glass cocks which appeared to us to entail unnecesary risk. The separated nitroglycerine ran down a gutter into a large drowning tank, whence it was removed from time to time. The separation of the various danger buildings was well effected, so far as the newer part of the factory was concerned, the distances being certainly not less than those we require, and the mounds being of considerably greater dimensions than are usual in Great Britain.

The method adopted for drying collodion cotton is curiously primitive; but they have decided to retain it, in spite of the many fires which have occurred. The operation is performed in a shed without walls and having a sand floor; the nitro-cotton to be dried is placed in large flat metal baths heated with hot water on the under side. Any accumulation of dust is prevented by the whole being set on fire after the removal of each charge. Since they have adopted this drastic method of cleaning by fire, the fires in the ordinary working have not been so frequent. An ammonium-nitrate explosive, called Baelenite, is also made at this factory, the ingredients being incorporated in a mill with suspended runners. All this work is carried out in one block of buildings adjoining the boiler-house. In the mill they occasionally have slight explosions under the runners; but, so far, these have never spread to the rest of the explosive on the bed.

A few years ago they began to make electric fuzes and detonators. At first they mixed the composition in the laboratory; but considering this to be too dangerous, an apparatus was made for mixing. It consisted of a barrel with lead balls in it, and it was rotated by means of a rope from a distance of 50yds. It only lasted for about 2 minutes. At this factory we heard a curious story of an explosion which occurred at Arendonck, a nitroglycerine factory not far from Baelen. An explosion occurred some 10 years ago in the nitro-glycerine washing house, and no cause had ever been assigned for it, until a short time ago, when the foreman of the house was dying, he confessed that, on the evening before the explosion occurred, he had brought a bucket of impure nitro-glycerine into the house; his duty was to have washed this at once, but as it was late and he wanted to get away, he merely put some dry soda and some water into the bucket with the nitroglycerine and left it, intending to wash it in the morning. During the night the house exploded, evidently from the action of the strong soda upon the impure nitro-glycerine, though from ignorance of the facts this cause was never suspected by those in charge of the factory.

HALTERN.

The factory of the Westfälisch-Anhaltische Sprengstoff Actien Gesellschaft is situated on high moorland near Haltern, which is about one hour by train from Düsseldorf. On the occasion of our visit we were accompanied by Herr Buchloh, one of the Directors of the Company, and Herr Hiller, the Manager at Haltern. The factory is well situated as regards

dwelling houses, and as far as we could see fully conforms to British requirements in this respect. It is used exclusively for the manufacture of blasting explosives containing nitroglycerine, both for general use and for use in fiery mines.

Manufacture of Nitroglycerine.

Several points of interest are to be noted on the nitroglycerine hill here; of these we will only refer to those which tend towards greater safety. Every door in these houses is provided with a leather pad so hung by a short strap that it prevents the door from banging if it should be left open, thus avoiding both the sudden blow which would otherwise be given on a surface which might possibly have a film of nitroglycerine on it, and also avoiding any alarm being occasioned to the men working in the house by the sudden noise. The houses are connected by gutters running through tunnels in the mounds, each end of these tunnels is closed with a heavy wooden door, and an arrangement, similar to that of a railway signal, indicates to the manager at almost any point in the factory whether these doors are open or shut, thus affording him some means of knowing what is going on at the time. In both the nitrating and washing houses they have cylinders of compressed carbonic acid gas continually connected with the air pipes, so that in the event of a failure of the air supply the stirring can be continued with this gas if necessary. The surface injection of glycerine is used, the glycerine being sprayed into the nitrator through a small vent with a conical opening arranged in the cover of the nitrator. This does away with the heavy tubular injector commonly found in British factories.

The larger buildings in the factory are 80 metres apart, and the magazines 150 metres. All buildings are completely surrounded by high and thick mounds of earth, and in spite of the absence of any description of overshoes, are, on the whole, very clean and well kept. A special feature which struck us was the spaciousness of the buildings, as they are not so strictly tied down in the matter of distances as are our manufacturers, the temptation to cut down the size of the building with a view to saving ground is not so great. In any general revision of our table of distances it will be worth considering whether distances should not be measured from centre to centre of each building with a view to reducing the disability entailed by the use of large buildings. This remark as to the size of buildings applies to nearly all the German factories. It is noteworthy that in this factory they adopt a higher standard of purification for nitro-glycerine intended for export to this country, nitro-glycerine for home use being washed till it gives a heat test at 167° F., whereas that for British use is tested at 192° F. The abolition of earthenware cocks initiated by Major Nathan at Waltham Abbey a few years ago has here been effected in the filter house, but not as yet elsewhere. The after separation is similar to that at Baelen, already described.

In the gelatinizing houses all the mixing is done by hand, the use of machines for this purpose being prohibited. This, while tending no doubt to safety in manufacture, appears to us to render an even incorporation of the ingredients somewhat improbable, and, therefore, to increase the dangers in use. As to the merits of the two systems, it is very difficult to come to any definite conclusion; but we are on the whole, inclined to prefer the English system of machine mixing and more perfectly incorporated explosives.

TROISDORF.

In company with Dr. Müller and Dr. Seyfferth we visited the works of the Rhenisch-Westfälische Sprengstoff Actien Gesellschaft at Troisdorf, near Cologne. At these works the manufacture of detonators, fuses and smokeless powder is carried on. In the manufacture of detonators they are now using considerable quantities of tri-nitro-toluol, a substance which is very much safer to handle than fulminate of mercury, and the manufacture is therefore to a certain extent rendered safer by its use; but all such detonators require a priming of fulminate, and as soon as this is introduced the risk becomes the same as with the older pattern. With regard to the precautions adopted in manufacture we came to the conclusion that the best of the British factories have in this respect nothing to learn from this factory.

In the smokeless powder factory most of the operations are carried out with wet explosive, it being forbidden in Germany to use the dry process for the manufacture of smokeless powders. It has not been found practicable in England to adopt this method to any very great extent, the difficulties being very largely increased by the use in most of our smokeless powders either of nitroglycerine, or of some soluble salt in admixture with the nitrocellulose. A very noteworthy detail in connection with this factory in particular, and to a less degree with all the German factories, was the very great attention which is paid to the comfort and well-being of the workpeople in the matter of the provision of dining and dressing-rooms. The latter have generally facilities for bathing and many other conveniences, the whole being of most ample proportions and kept beautifully clean and smart. At this factory we also saw the new plant which has just been erected for the manufacture of celluloid and similar substances.

SCHLEBUSCH DYNAMIT-FABRIK.

The Dynamit-Fabrik at Schlebusch is about two miles from the station of that name, and about nine miles from Cologne. Here only nitroglycerine explosives are produced. In the nitrating and separating house an excellent arrangement has been installed whereby in the event of an alarm all the cocks to the drowning tanks can be turned on by means of a piston driven by compressed air, which can be operated by turning on a small air valve outside the mound of the building; this piston is connected by link work to the taps of the cocks in such a way that the ordinary hand working of the cocks is but very slightly hindered, and at the same time the pneumatic system is always in gear for use in emergency.

Owing to the site of the factory being on the side of a hill it is possible to run the nitroglycerine by gravity to the mixing house, thereby avoiding the presence of dry and dusty nitro-cotton in the washing house. The rules prohibit the presence of any persons in the incorporating houses whilst the machines are running, and to ensure the observance of this rule they have designed an ingenious contrivance whereby the gate leading to the house must be shut before the machine is started, and cannot be opened again until it has been stopped. No nailing down of cases is permitted in the packing house, this operation being carried on in an annexe to the building, to which each case is taken to be nailed up as it is finished.

SCHLEBUSCH CARBONITE-FABRIK.

The only building of the Carbonite Factory proper at Schlebusch which was visited by us was one of the magazines,

the time taken up in visiting the laboratories and testing stations not allowing us to visit the working buildings. The magazine was of a new type, being constructed entirely of concrete made with fine gravel and covered over with a thickness of earth of not less than one metre in any part. The intention of this construction is to prevent the projection of heavy debris in the event of an explosion. We are not aware whether this claim has been verified in actual practice; but the principle is one which has already been suggested by Mr. Oscar Guttmann, who, however, instead of the fine gravel, suggests the use of metal filings and turnings and other similar small workshop scrap with the intention of also providing a metallic cage to serve as an additional protection against lightning.

CASTROP.

The factory of the Castroper Sicherheit Sprengstoff Actien Gesellschaft at Castrop, about six miles from Dortmund, is at present used only for the manufacture of Dahmenite. This is an explosive which is authorised in Great Britain, but of which we have seen very little in recent years. It is an explosive of the nitrate of ammonium class, which has passed the tests necessary to allow it to be conveyed by ordinary goods train in Germany. The factory, as is usual in Germany with those of this class, is all under one roof, no distances being imposed. A few years ago a very serious fire occurred, which practically destroyed the whole factory. It has since been rebuilt, and, as far as possible, no inflammable materials have been used in the construction. By this means they hope to avoid any extension of a fire beyond the room in which it breaks out.

MUIDEN.

The factory of De Gesamenlijke Buskruidmakers van Noord-Holland, Utrecht en Zeeland, is at Muiden, about five miles from Amsterdam. The degree of precautions taken here attains to the standard of our best British factories, and in regard to the black powder portion exceeds that standard in respect of the extreme care which is taken in keeping the quantities of the powder in the buildings down to an amount which our powder makers would declare quite unworkably small. This is effected by the use of expensive magazines for each working building and the employment of service waiters, who are continually bringing fresh supplies of powder to the houses, and removing that which has undergone the operations performed in that particular house; no powder is brought to, or allowed to remain in, the house, except such quantity as is immediately necessary for the operation in progress. Another noteworthy point is the extreme care which is taken in having as much of the machinery as is possible in an annexe to the danger building, separated therefrom by a very substantial wall. Most of the operations of starting, stopping, etc., are performed in these annexes Smokeless powder is also made in this factory. Beyond the general excellence of the method of working, nothing was specially noteworthy except the liberal provision of drenchers worked atomatically by the usual strand of guncotton.

GERMAN REGULATIONS.

Appended to this report are translations of the Special Rules for Nitro-glycerine and Detonator Factories in Germany. The first section of the report concludes with a gracious acknowledgment for the kindness and courtesy extended to the visitors in the course of their journey, and particularly for permission to visit the factories above named.

(To be continued.)

THE SHORT LEE-ENFIELD RIFLE.

BY MAJOR W. B. WALLACE.

Extracted from an Article in the Journal of the United Service Institution of India, July, 1905.

IN the past, for a great number of years, the chief shooting test for accuracy has been from the Whitworth rest. In using this apparatus the fore-end of the rifle is taken off, and the barrel is clamped to a heavy metal fore-end which slides in guides upon the bed of the rest. This rest shows whether a barrel is capable of making a good group, but as its weight damps the vibrations of the barrel, and as the rifle is not fired with its own fore-end the diagram obtained is no criterion of what the rifle will do when it is fired stocked up from the shoulder.

To overcome these difficulties, ranges of 100 ft. in length have now been established at all the small arm factories turning out Government rifles. Every rifle is now fired in them, stocked up, and has to place its group of shots in a given rectangle before it is issued to the service. This system of shooting every rifle has been applied to the later issues of Lee-Enfield rifles. After being fired at 100 ft., 10 per cent. of the rifles are also given a further shooting test at 600 yds. To facilitate the adjustment of the sighting, the barleycorn of the new rifle is dovetailed to the foresight block, so that it can be moved laterally to correct any error in direction. To correct a vertical error in the sighting, three different heights of barleycorns are made, marked H. (high), N. (normal) and L. (low). The rifles are first tested with the normal barleycorns, any that shoot too high are fitted with the low barleycorn, and *vice versâ*. If this does not effect the required correction, the rifle is overhauled and adjusted, generally by means of a slight alteration to the breeching up, or to the stocking, or by changing the bolt.

The shooting tests described above are carried out with the backsight slide in the lowest position, viz., at 200 yds. elevation. When this is correct it is certain that all the other elevations are true to the standard sighting curve, for the other elevations are all carefully measured heights above the 200 yds. elevation. This standard sighting curve gives the elevation required at each range under normal atmospheric conditions; and is found practically by firing a number of the rifles at every range, and then taking the average of the elevations used at each range. This shooting is carried out at Hythe, in suitable weather by the finest marksmen available.

With regard to the criticism that the design of the sights of the Lee-Enfield rifle is antiquated; this may be accepted as well founded; for the present design has been used on our rifles since the days of the Enfield rifle in 1852. The improved backsight adopted for the short Lee-Enfield rifle is provided with a wind gauge, and with a cap, which may be slightly raised or lowered by means of a fine adjustment screw, when very small differences of elevation are required.

Some critics have condemned the addition of the wind gauge, and fine elevation, as being unnecessary; because they would be but rarely used on service. It must be remembered however that these adjustments will be most helpful in the musketry training of the soldier; they will encourage a taste for rifle shooting; and will enable higher scoring to be

attained which will have a good moral effect on the soldier by increasing his confidence in his weapon.

We will now describe the parts of the rifle in detail, taking the barrel first. The shortening of the rifle has been entirely effected by shortening the barrel; this therefore is 5 ins. shorter than that of the Lee-Enfield rifle; it is however 4 ins. longer than that of the carbine. It is also considerably thinner than the barrel of the old rifle, as will be seen from the following table:—

Rifle.	Bore.	Thickness of barrel at muzzle neglecting the depth of the rifling.
	Inch.	Inch.
Short Lee-Enfield	0·303	0·127
Lee-Enfield	0·303	0·175
Mexican Mauser	0·276	0·166
Dutch Mannlicher	0·256	0·145

This table includes the latest pattern of Mauser and Dutch Mannlicher rifles for comparison. The barrel is amply strong enough to fire cartridges giving a pressure 50 per cent. greater than that of service cartridges. The reduction in length and thickness effects a saving in weight of about ½lb. The reduction in thickness however makes the rifle sensitive to small variations in the stocking up.

The stocking up of the new rifle differs considerably from that of the Lee-Enfield rifle. The butt is of similar shape, but slightly thinner all over. It has four longitudinal holes bored in it for lightness. The butt plate, made of sheet steel, is lighter, and has no butt trap; for the soldier will carry the mineral jelly and pull through in a tin box in his haversack. Three lengths of butts will be issued; some of the present length, others ½ in. longer, and ½ in. shorter. It is hoped by this means to improve the snap shooting of the army; and to reap the full benefit of it, the men will have to be as carefully fitted with butts as they are with boots. In fitting them, it is suggested that an officer should make the men throw up their rifle to the present, and snap at his eye. They will do this most easily with the butts that fit them best.

In very dry climates it is found that the butt of the Lee-Enfield rifle is liable to shrink; the socket end then becomes loose in the socket of the body, and the constant jarring the rifle receives when it is carried by mounted men causes the stock bolt to unscrew gradually. To overcome this defect, the socket end of the butt of the new rifle is impregnated with paraffin wax, to keep out moisture; it is then compressed by machinery to consolidate the wood, and is then forced into the socket of the body, so that there is very little likelihood of the wood shrinking any more. To prevent the stock bolt accidentally turning, the front end is cut square and projects beyond the front face of the socket of the body. The square end fits into a square notch in a keeper plate which is let into the rear face of the fore-end. It is therefore impossible for the stock bolt to turn unless the fore-end has been removed.

The handiness of a rifle depends on the following conditions being fulfilled:—

1st.—The parts gripped by the hands when at the present must be of convenient shape, and the trigger must be within easy reach of the small of the butt. In the new rifle the small is slightly reduced in thickness, which makes it more comfortable, and the shape of the trigger is rather more curved which is an improvement.

2nd.—The position of the centre of gravity of the rifle must be a little in rear of the point where it is grasped by the left hand. If it were too far back, there would be a tendency to fire over the object in snap shooting and *vice versa*. Although the new rifle is 5 ins. shorter than the Lee-Enfield and has a thinner barrel the position of the centre of gravity is maintained by lightening the butt and the butt plate.

3rd.—The rifle should be light, as it can then be brought more smartly to the shoulder and be more rapidly aligned. The new rifle has an advantage of fully 1 lb. in this respect over the Lee-Enfield.

4th.—The length of the radius of gyration about the centre of gravity should be small; *i.e.*, the weight of the rifle should be concentrated as much as possible near its centre of gravity. The rifle can then be quickly pointed in any direction, and its motion rapidly checked. It is possible to have two rifles of identically the same shape, and weight, with their centres of gravity in exactly similar positions, yet one may be sluggish, and the other whose weight is concentrated near the centre of gravity, will feel much lighter and handier in use. This condition is fulfilled in the new rifle, as its weight is concentrated more towards the centre; for the weight has been removed from the front, by shortening and lightening the barrel; and from the rear end, by lightening the butt and butt plate.

REVIEW.

Curso Elementar sobre Substancias Explosivas, by Captain Simoes. Vol. I., Explosive Materials and Gunpowder. 8vo., 427 Pages. Published Lisbon, 1904.

THIS is the first of three volumes on explosives and their manufacture. The second volume is on explosives generally, and the third on pyrotechnics, ammunition and the application of explosives. If we are to judge the whole series by the Volume before us we should say that the work is on the lines of J. Upman and E. Von Mayer's, or better known as E. Desortiaux's treatise on gunpowder and explosives. Being a later work it is more up-to-date and having its origin in Lisbon, contains matters special to Portugal. It contains 163 illustrations, but these are of diagramatic character. The subject matter covers the usual ground, viz., brief descriptions of the materials used in the manufacture of explosives, a detailed account of the manufacture of gunpowder with descriptions of its proof closing with a statement of the theory underlying the combustion and detonation of explosives. To the English reader we cannot say that this volume contains matter not dealt with in our literature; on the other hand, to readers of Spanish the work is a complete and comprehensive treatise on the subject of explosives.

TRADE MARKS.

ADVERTISED. AUGUST 2—30, 1905.

274,276. The word BANGO. To apply to bullets. Lane Bros., London. July 12, 1905.

REGISTERED. JULY 20—AUGUST 23, 1905.

272,934 } Curtis's and Harvey, Ld.
272,935 }

272,175. The Explosives and Chemical Products, Ld.

APPLICATIONS FOR PATENTS.

JULY 17—AUGUST 19, 1905.

14,676. Flying Target. W. W., and H. J. Watts, and K. G. D. Browne.
14,746. Ordnance Projectiles. W. Tucker.
14,772.* Bullets. F. M. Aspinwall.
14,832. Small-Arms. R. Royston.
14,904. Torpedoes. T. G. Wilks.
14,911. Fuse for Lyddite Shells. H. H. Mulliner and F. Wigley.
14,912. Graze Fuse for Shells. H. H. Mulliner and A. C. Lochénies.
14,958.* Nitroglycerine Explosives. Deutsche Sprengstoff Akt. Ges, Germany. (Date of application in Germany, December 10, 1904).
15,050.* Blasting Cartridges. C. D. Abel. (Agent for *Rheinische Metallwaren und Mf*).
15,222. Electric Blasting Fuse Head. F. Render.
15,263.* Magazine Rifles. G. Hagen. (Date of application in Germany, July 26, 1904).
15,332. Wad Punch. S. Heath and B. Dance,
15,564. Smokeless Powders. A. T. Cocking and Kynoch Ld.
15,565. Smokeless Powders. A. T. Cocking and Kynoch Ld.
15,566. Smokeless Powders. A. T. Cocking and Kynoch Ld.
15,580.* Percussion Fuses. A. E. Edwards. (Agent for *J. L. Sticht*).
15,583.* Ordnance Brake Mechanism. Fried. Krupp, Akt. Ges. (Date ot application in Germany, October 20, 1904).
15,601.* Automatic Fire-Arms. C. Freeman. (Date of application in U.S.A. August 15, 1904).
15,611. Small-Arms. J. W. Wyatt.
15,643.* Gas Check for Ordnance. Fried. Krupp, Akt. Ges. (Date of application in Germany October 29, 1904).
15,904. Air-Guns The Birmingham Small-Arms Co., Ld., and G. Norman.
15,911. Small-Arms. P. T. Godsal.
15,928. Built-up Ordnance. A. T. Dawson and G. T. Buckham.
15,943. Sighting Devices. T. G Russell.
15,982. Automatic Fire Arms. W. J. Whiting.
15,998.* Fuse. G. Deisenhoffer. (Date of application in Germany September 3, 1904).
16,002. Explosive Compound. W. Upton.
16,062.* Cartridges. J. C. Sellars.
16,474. Projectile. P. R. J. Willis. (Agent for *J. Shearman*).
16,483. Targets. W. D. Kimber. (Agent for *A. M. Fitchie and F. Margrie*).
16,514. Explosives. W. Macnab and the Ammonal Explosives, Ld.
16,558.* Range Finder. R. H. Owen.
16,677. Range Finder. N. Eliot and A. G. Fleming.
16,724. Electrical Ordnance Working. A. T. Dawson and J. Horne.
16,725. Machinery for Working Ordnance. A. T. Dawson and J. Horne.
16,859. Projectile Fuse. C. G. Gerrard.

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

JULY 27—AUGUST 24, 1905.

COMPILED BY HENRY TARRANT.

11,535 (1904). **Improvements in Telemeter Construction**. W. H. Lock and A. H. Pollen, London. (This specification is a Secret Document).

16,919 (1904). **Recoil Operated Firearm**. A. E. Hall, U.S.A. Recoil operated rifle mechanism in which two screws, revolved by the movement of the breech bolt, are adapted to govern the speed of the movement of the bolt. Attached to the end of each screw are centrifugal governor balls which press the screws into frictional contact with surfaces in the frame of the rifle. Accepted July 27, 1905.

17,406 (1904). **Target Operated without Projectiles**. The Auto-Electric Rifle and Target Co., Ld., London (Agents for *The Automatic Target Machine Co., U S.A.*). In the United States Patent No. 708,245, 1902, and the British Patent No. 15,453, 1901, are set out the descriptions of a class of target apparatus with which is employed an imitation firearm mounted on a universal joint which permits it to be aimed at the target. On pulling the trigger the point aimed at is indicated on the target without the issuance of a projectile. The object of the present invention is to construct a relatively simple and inexpensive recreation device for effecting the purpose explained above. Accepted July 13, 1905.

17,410 (1904). **Targets Operated without Projectiles.** The Auto-Electric Rifle and Target Co., Ld., London (Agents for *The Automatic Target Machine Co., U S.A.*). Apparatus wherein an imitation firearm mounted on a joint, is directed towards a target and the aim is automatically indicated, is dealt with in this Patent Specifications Nos. 708,245, 1902 (U.S.A.), and 15,453, 1901 (British), hold a full description of the apparatus which by the present patent is modified so that the shooter may be provided with a tangible record of his marksmanship. Accepted July 27, 1905.

17,719 (1904). **Range Finder** Com. T. S. Dumaresq, Alton. Dealt with in this patent is an instrument designed to give rapidly the required rate of change of range and the deflection necessary for keeping the line of sight of a gun on the object when either the ship or object is moving. Accepted July 13, 1905.

17,731 (1904). **Air Gun Targets**. R. Riley, Walsall. To prevent disputes, the patentee has designed a target, the sections of which when struck by a pellet cause a number to drop and so to indicate which part was struck. The numbers are carried back into position, or the bulls-eye bell is stopped from ringing, by pulling a cord at the firing point. Accepted July 20, 1905.

18,261 (1904). **Recoil Apparatus of Ordnance**. Lieut A. T. Dawson and G. T. Buckham, London. A device applicable to carriages and mounting for guns of the Howitzer type, by means of which the length of recoil of the gun is automatically shortened by increase of elevation so that the rear of the gun does not contact with the ground. The recoil cylinder capable of axial displacement depending on the angle of elevation, is furnished with a piston having apertures more or less opened in accordance with the degree of axial movement imparted to the cylinder. Accepted July 20, 1905.

18,261A (1904). **Elevating Gear of Ordnance.** Lieut. A. T. Dawson and G T. Buckham, London. A method of moving a high angle gun quickly from high elevation to the loading position, consisting in using two screw-threaded portions capable of independent action. One portion is slow in action for fine adjustments of elevation, whilst the other is quick in its action for larger adjustments. Accepted July 27, 1905.

18,824 (1904). **Breech Action for Magazine Rifles**. P. T. Godsal, Iscoyd Park, Flintshire. In Patent No. 22,003 was described a magazine-rifle breech-action consisting of three parts—a cylindrical rotatable block with a non-rotatable head in front of it, both of which were carried in the front end of a part called the carrier. The carrier contained the striker and mainspring. By the present invention this construction is simplified and the parts lightened without detracting from its strength. The trigger and trigger guard are also if necessary dispensed with. Accepted July 6, 1905.

18,601 (1904). **Increasing Ballistic Action**. C. Puff, Germany. A method of increasing the ballistic performance of a firearm without changing the weight of bullet or the maximum gas pressure, consisting in building the barrel so that its calibre decreases gradually from chamber to muzzle. The bullet is adapted to fit the larger end so that the area upon which the gases operate is larger when the bullet starts than when the bullet has been squeezed through the narrower muzzle end. Accepted July 27, 1905.

19,166 (1904). **Apparatus for Testing Time Fuses**. Colonel H. C. L. Holden, R.A., Woolwich. Apparatus for testing times fuses consisting of a holder for the fuse which is rotated by any convenient means at a velocity up to that which it would have in actual use. Whilst revolving, air under pressure is supplied in such a manner as to simulate the conditions which obtain when the fuse is in its projectile and is passing through the air. Various devices are used for automatically starting the action of the fuse, for recording its time and characteristics of burning, and for varying the air pressure so as to represent what occurs during trajectory. Accepted July 6, 1905.

20,069 (1904). **Ordnance Sights**. Lieut.-Col. L. K. Scott, Farnborough, Hants. An improvement in gun sights of the type

set out in patent No. 25,585, 1901, is dealt with in this specification. This sighting apparatus is primarily adapted to the carriage of a disappearing gun, but the details of construction of the sight are also improved. Accepted July 13, 1905.

20,203 (1904). **Ordnance Sights**. Lieut.-Col. L. K. Scott, Farnborough, Hants. The amount of deflection available in the present sighting apparatus for ordnance has not sufficed to enable the gunner to utilize, as points of aim for "indirect" laying, all the different points in the field of view to the right and to the left of the line of fire of the gun. A method is set out in this patent of remedying this defect by a mechanical application of "all-round" deflection to the line of sight. Accepted July 20, 1905.

20,654 (1904). **Disappearing Target Apparatus**. J. Gorst, Chester. Target apparatus applicable particularly to miniature rifle ranges, consisting of a frame carrying wires upon which the targets run. A wheel at the firing point regulates the running movement, whilst a sliding rod is operated to cause the targets to disappear from the sight of the shooter. Accepted July 27, 1905

20,692 (1904). **Silence for Guns**. A. Thompson, London. A method of muffling the sound of the firing of Maxim or other repeating guns, consisting in mounting a cylinder in front of the muzzle, concentric with the barrel. The cylinder is divided into a series of expansion chambers by an arrangement of diaphragms. The diaphragms are bored to allow the bullet to pass, but the recoil of the gun closes the hole in the cylinder head after the bullet has passed, and so confines the gases of combustion. They pass from chamber to chamber, and gradually escape through a hole in the last one. Accepted July 6, 1905.

24,882 (1904). **Sighting Device for Use Behind Cover**. H. J. Haddon, London. (Agent for the *Max Haeussler, Germany*.) Two mirrors are arranged in such a manner that the light rays travelling over the sights in the ordinary way are reflected downwards to the shooter concealed behind cover. The reflecting device may be attached by a bow to any rifle barrel without needing any alteration of the usual sights. Accepted August 3, 1905.

27,749 (1904). **Destruction of Birds of Prey**. E. Müller, Bralitz, Germany. A spring gun is set on a roof or tree top or in some such suitable position so as to attract birds as a place on which to perch When the bird settles on the gun its weight presses a knob on a cylinder down, and discharges the cartridge in the tube beneath. The bird receives the bullet in its body through a hole in the knob Accepted August 3, 1905.

3,024 (1905). **Self-Registering Targets**. A. Beedham, Manchester. In targets having a scoring face formed of different sections capable of being moved by the impact of the bullets, the patent proposes to combine the sections with pendent levers, which, when moved by the shot, drop numbered indicators corresponding with the portion of the target struck. Accepted July 13, 1905.

5,519 (1905). **Rifle Carrier for Mounted Men**. H. E. Coles Ockbrook. A rifle carrier designed to relieve a mounted man of the weight of the weapon, consisting of a hook of steel strapped on to the heel side of the butt, and adapted to hook on to the stirrup iron. Accepted July 27, 1905.

7,723 (1905). **Rifle Cartridge Loading Machine**. D. Larsson, Sweden. Apparatus designed especially for private use for clubs, to enable the members to reload their own rifle cartridges. The machine principally consists of a drum adapted to contain the shells. This is turned step by step to present the cases in turn to the capping, powdering and bulleting arrangements. Accepted August 3, 1905.

8,284 (1905). **Automotor Torpedoes**. H. A. Noalhat and G. Fournier, Paris, France. Three fly-wheels are so arranged in an automotor torpedo, that each is adapted to actuate the driving shafts of the propellors. Each shaft is divided into three lengths, and the ratios of the trains of gearing to each of these lengths are different from each other, so that the fly-wheels may be rendered successively operative upon the driving shafts. Accepted July 6, 1905.

10,284 (1905). **Miniature Rifle Practice Targets**. Capt. J. W. Reid, London. Developments of the target apparatus set out in Patents Nos. 1773 of 1881, and 3,120, 1883, whereby a row of practice targets can be simultaneously displaced vertically by equal amounts, and at various rates, so as to simulate the continuously changing distance of retiring or advancing troops. The targets are designed for military practice purposes, with miniature ammunition shot either from rifles or ordnance. Accepted July 13, 1905.

11,400* (1905). **Small-Arm Trigger Arrangement**. J. Robertson, London.

11,400A* (1905). **Trigger Pull Adjuster for Small-Arms**. J. Robertson, London.

11,860 (1905). **Electric Target Setting Apparatus.** A. J. Boult, London (Agent for *Phönix Elektrotechnische Gesellschaft, Germany*). A target setting device is operated by an electromagnet with two coils. The reciprocating coil produces angular movement of the distant target through the medium of suitable gearing. Accepted July 20, 1905.

13,243 (1905) **Cage for Transporting Pigeons**. P. Girard, France. A cage for transporting pigeons, consisting of a construction of light but strong metal bars. Over the bars a wire netting is arranged. Stealing is prevented, and ventilation is secured by this arrangement. Accepted August 3, 1905.

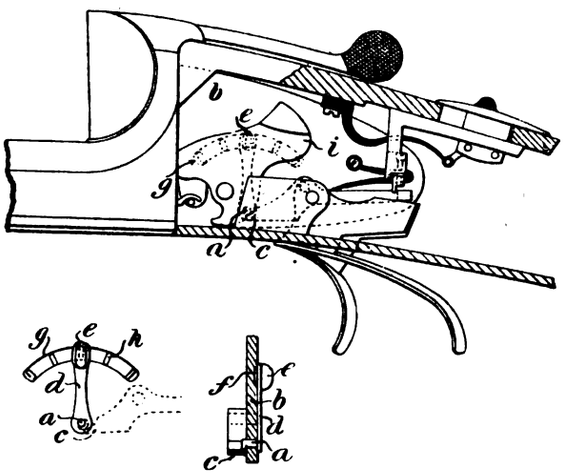
13,680* (1905). **Safety Device for Revolvers**. O. Turnay, London (Agent for *Colt's Patent Fire-Arms Mfg. Co., U.S.A.*).

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

ADJUSTER FOR TRIGGER-PULL OF SMALL-ARMS.

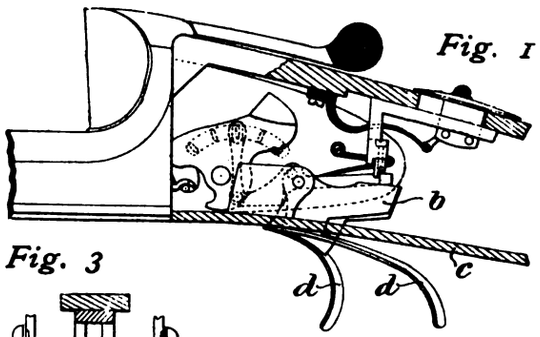
11,400A (1905). J. Robertson, London. A device is so arranged on the lock plate of a gun that a slight movement of it raises or lowers the sear nose ever so slightly and so takes it further into or out of the bent in the hammer. The weight of the pull can by this means be altered at the will of the shooter to counteract wear or any other such cause.

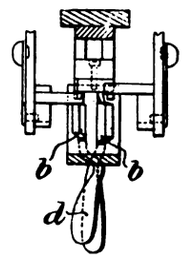


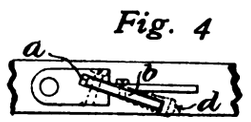
The device, which is illustrated in the drawings reproduced, consists of a slightly eccentric pin *a* (greatly exaggerated in the illustrations) which works in the lock plate *b* and engages the sear nose *c*. The outer end of the pin *a* is attached to the spring arm *d* which possesses the head *e*. The head *e* is provided with an internal projection *f* working over the quadrant *g*, and it is adapted to engage either of the recesses *h* lying between swells so as to retain the arm *d* in any desired position. By turning the spring arm, the eccentric *a* will force the sear nose slightly downwards against the action of the sear spring or permit it to rise, according to the direction in which it is turned. The extent of the engagement of the sear nose with the bent in the hammer *i* is thus either diminished or increased. Accepted Aug. 3, '05.

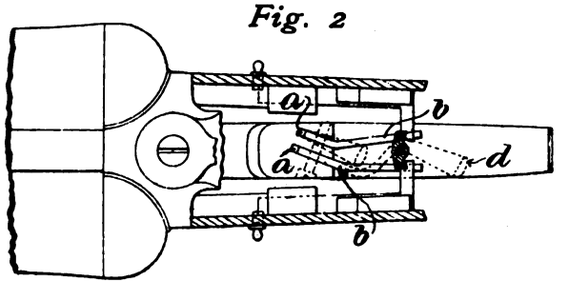
ARRANGEMENT OF SMALL-ARM TRIGGERS.

11,400 (1905). J. Robertson, London. A method of insuring that the pull upon the trigger of a small-arm shall always be at a right angle to the plane of the vertical movement of the blade, is set out in this patent. The tendency to bind the lower end of the blade against the slot in the trigger plate, so interfering with free firing, is obviated.









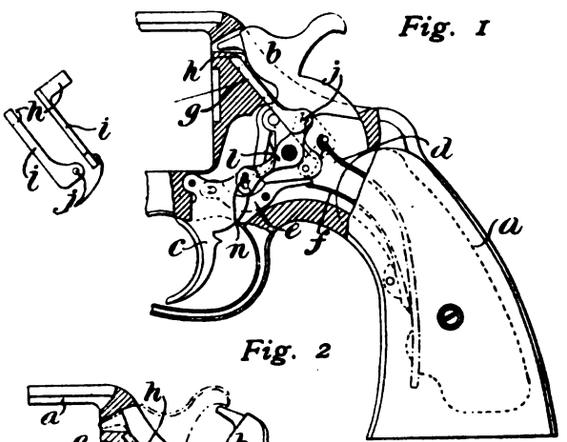
Instead of arranging the slots *a*, through each of which the lower end of one of the trigger blades *b* works, in a line approximately parallel with the trigger plate *c*, they are cut obliquely. The triggers *d*, together with the bottom parts of blade *b*, are set at a corresponding angle. The upper parts of the blades are as usual in a plane roughly parallel to the centre line of the action. Any peculiarity in the pull of the shooter which would tend to draw the trigger aside does not by this arrangement affect the movement transmitted to the upper part of the blade. In the case of double-triggered guns it is necessary to twist the connection between the rearward trigger and its blade, as is illustrated in Fig. 2 in dotted lines, to allow of its lying in proper position behind the forward trigger. A single-trigger would be arranged as shown in Fig. 4. Accepted July 20, '05.

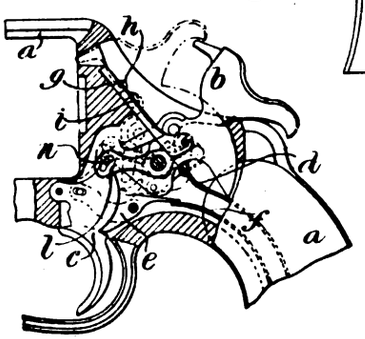
SAFETY DEVICE FOR REVOLVER AND SMALL-ARM MECHANISM.

13,680 (1905). O. Imray, London. (Agent for *Colt's Patent Firearms Mfg. Co., U.S.A.*) A safety device principally intended for revolvers, but applicable also to other firearms, is described in this specification. The safety is specially designed to obviate the disadvantages attaching to other types dealt with, and to combine their better qualities. Thus the safety consisting of extra sears is said to have a hold upon the hammer not strong enough to withstand a violent blow; and the safety of the block type is either precariously governed by a spring, or is arranged in such a position as to cause the hammer and pivot to be strained when the block intercepts the blow of the hammer. The safety device described in this specification is of the block type, but its various positions are regulated by the movement of the trigger through a double-armed lever pivoted at the side of the hammer.

The device is illustrated in the appended drawings. In the frame *a* of the revolver, the hammer *b*, the trigger *c*, and the rebound lever *e* are mounted in the ordinary way and are actuated by the main spring *d* and the combined rebound and trigger spring *f*. The part of the frame upon which the hammer bears when in the full-down position (see dotted lines Fig. 2) is cut away at *g* to receive the safety block *h*, and to guide it in its up and down movements. The safety block consists of the solid bar *h*, in length equal to the width of the hammer, from which depends the arm *i*. The lower end of this arm carries a projecting pin *j*. The left-hand side wall of the frame is recessed to receive the arm, but the recess is not shown in the drawings except in dotted lines.

The two-armed lever *l* is mounted upon the same pivot as the hammer, and it is arranged to lie between the hammer and the arm *i*. One arm of the lever is connected by the pin *n* working in a slot in the lever, to the trigger blade, whilst





the pin *j*, on the arm *i* of the safety, works in a slot in the other end of the lever. When the trigger is in the normal position, illustrated in Fig. 1, the block lies just below the striking point of the hammer, and prevents the point from reaching the cartridge cap. When the trigger is pulled to cock the hammer the lever *l* is turned upon its pivot and the block *h* is draw downwards. When the hammer is impelled forward by the main spring the block occupies the position shown in Fig. 2 in dotted lines. The hammer is allowed to travel forward to its fullest extent, the block lying in the recess in the face of the hammer just above the joint by which the strut is pivoted to the hammer. On the release of the trigger the lever *l* carries the safety up again into its original position in front of the rebounded hammer. Accidental discharge is positively prevented. Accepted Aug. 3, '05.

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CONTENTS.

CURRENT TOPICS.

The Shooting Season.—All accounts seem to agree that the shooting season which is now in full swing is beating all records. The bags reported from the different shooting centres bear evidence of a large head of game; but it is in the department of cartridge manufacture that the best index of the season's sport is to be obtained. Manufacturers of powder and cartridge cases unite in agreeing that the consumption up to date has easily surpassed all previous records. From comparing the two sources of information it must be assumed that not only has the head of game been above the average but that a large amount of powder and shot beyond the proportion of ordinary years has been expended in bringing it to bag. In other words the game is exceptionally forward for the time of year, so possessing a degree of wildness that involves the making of more than usual noise for a given head bagged. Reports from the wildfowling districts appear to show that the migrant visitors have put in an appearance before their usual time. This again tends towards increased activity in the cartridge business. The humble wildfowler may not occupy so important a position in the affections of the gunmaker as the partridge and grouse shooting customer, but he is nevertheless an important factor in the consumption of supplies. In wending his way amidst the marshes and the scantily-stocked uplands he encounters many temptations to try his luck at long shots. In fact all the circumstances that tend to make the opening of the shooting season successful appear to be in satisfactory evidence at the present time of writing. The supply of pheasants will not of course materially influence results for some time to come, but as there is the usual evidence of well-filled preserves it may be assumed that sport will proceed for the remaining months of the season with much the same degree of activity which has marked the opening period. With everything working so well it is to be hoped that the results for the gunmaker will be of a high order.

Lightly Charged Cartridges.—So far as we have been able to gather from the particulars which have reached us up to date the steps taken in various directions to extend the specialisation of lightly loaded cartridges have met with success. Shooters feel inclined to agree that the cartridge with a small charge of shot is the best possible accompaniment of a gun of light weight. In the past the tendency to reduce the weight of the shot gun to an unduly low level did not meet with any great success. Such weapons give more satisfaction when brought to the shoulder in the show room than when actually fired. The basis of the problem seems to be that weight cannot be reduced without reference to the coincident increase of recoil. A very few ounces taken away from the weight of the gun produces a disproportionate rise of recoil. Hence it must follow that any change made in the gun must be accompanied by an equally drastic alteration in the loading of the cartridge. It is not to be supposed that every shooter who elects to use a light gun is prepared to pay for the extra comfort of carrying it by discomfort and want of success when actually using it. Experience having shown that ordinary charges are prohibitive in a light gun the more recent tendency

has been to revert to the 6¾ lbs. weight as the most favourable for a 12-bore. Such a weapon may be used with comfort when the cartridge contains the usual ounce-and-a-sixteenth of shot, the disturbance due to recoil being lessened still further when the charge becomes one ounce. The effectiveness of the second barrel forms such an important factor in the success of a day's sport that a cartridge which minimises recoil must be appreciated even by those carrying a weight of gun which affords security against injury to the shoulder. There may or may not be an advantage in the use of cartridges carrying out the idea of a diminished charge to an extreme point; but it is the office no less of the gunmaker than the cartridge maker to put forward every device that promises useful results, leaving it to the sportsman to decide in the light of practical experience whether such things are wanted.

The Testing of Smokeless Powders.—Some years have now passed since a determined joint effort was made by the powder makers to standardise their products upon clearly understood lines. The advances which have since been made may be regarded as highly satisfactory in themselves, even if they have been unaccompanied by any particular flourish of trumpets. It is only by comparing the methods of five years ago with those in vogue to-day that a full measure can be obtained of the progress actually made. The adoption of the same make of proof gun for all experiments, the recognition of simultaneous recoil measurements as a useful check on velocity, together with the use of the Gunmakers' Association standardised chamber have all produced their due effect. Not less than these modifications of previous methods is the acceptance of the 20 yards distance as the most favourable for judging the velocity of the cartridge. It must nevertheless be recognised that a serious hitch has marred the complete carrying out of the programme which was so confidently put forward a few years back. This has been the difficulty of securing adequate and suitable supplies of copper crushers. The ¼-in. by ⅛-in. size was originally accepted as the right thing to use. This is very similar in general dimensions to the size used by *M.* Jules Polain for his somewhat notorious multiple crusher gun. Experience has shown that this size of copper is irritatingly small to handle, and that the results obtained with it are by no means so reliable as was anticipated. The need then arose for a copper crusher having the sensitiveness of the size above mentioned, coupled with the liberal dimensions of the familiar lead plug which Messrs. Eley supply for use throughout the English-speaking world. Colonel Holden's brilliant idea of a conical copper met this requirement, but the practical adoption of the idea has been delayed pending the overcoming of manufacturing difficulties. We understand that there is now good reason for believing that these troubles are a thing of the past. Granting the possibility of supplies of copper of uniform ductility the mere question of making crushers has ceased to give trouble. We may accordingly anticipate that at an early date means will be available for taking full advantage of the testing facilities which have been jointly worked out by those anxious to promote uniformity in the powder.

Modified Cordite.—The close of the rifle shooting season seems to have brought to a finish all talk of the impending adoption of M.D.S. cordite, as we are now told we must call it. What with the uncertainty which surrounds the future of the new short rifle and the reports that continental nations are making a strenuous move towards velocities far beyond anything recently contemplated as practical, it is really very difficult to know what turn events may take. An impending change of Government necessarily encourages the permanent officials of our administrative departments to hold their hand in the matter of any revolutionary changes which might be adversely viewed by the incoming political chiefs. The Liberal Government would not be obliged to harmonise any action they might take in regard to armament with the previous decisions of the present Government. The important question of the infantry rifle and ammunition may thus be held in suspense pending a more settled political outlook. Meanwhile it is certain that the grade of ballistics, which can be obtained with every military rifle in the world except our own, may at any time become universal and force us to come into line. To adopt an improved scale of velocity the margin of strength possessed by the bolt must for common-sense reasons be greatly extended. The faulty design of the ·303 cartridge, and particularly its cap, must form an essential item in the reconsideration of the whole subject. For these and other reasons it is just as well that War Office developments should for the moment be confined to experiments with the ·22 calibre rifle. The newspapers will doubtless accept this evidence of activity as a suitable sign that the security of the country is adequately regarded. The service rifle and cartridge question may thus stand over, unless of course some simple stop-gap improvement can be devised in the meanwhile.

Steel for Rifle Barrels.—The fact that we generally devote a note in this column to the purpose of prefacing the month's lecture to young gunmakers may be used as a justification for referring to what may be regarded as a lecture to grown-up gunmakers. To some extent the surprise which has been caused in the past by Mr. F. W. Jones's apparently inexhaustible fund of information concerning the scientific aspects of gunnery has diminished. His justification for tackling difficult problems beyond the sphere of his ordinary work is that a foundation of pure science opens the door to all departments of knowledge. It must be regarded as highly beneficial to any trade that it should include amongst its number at least one individual who is willing to examine problems of a difficult nature with sole regard to the advancement of knowledge. The fact that so much of Mr. Jones's best information is freely bestowed on all who care to read his reports means that the conclusions at which he arrives are available for use by all who may desire to give them a practical application. In writing about barrel steel the researches of Mr. John Rigby and Mr. W. J. Whiting are immediately called to mind. Mr. Jones has tackled a slightly different branch of the same subject. That is to say he emphasises the relation which exists between the properties of steel under test and the stresses produced by the explosive action inside the gun. As consulting expert to the two proof houses Mr. Jones's practical knowledge of the subject is as much beyond question, as his theoretical knowledge whether regarded from the point of view of the chemistry of metals or the ballistics of smokeless powders. At any rate we have within us the feeling that Mr. Jones's article contains certain recommendations and conclusions which are worthy of more than passing interest.

CADET RIFLES.

THE decision of the War Department to adopt a miniature pattern of rifle for use by cadet corps, boy messenger brigades, rifle clubs and for drill hall practice may be productive of much good or evil according to the manner in which the problem is tackled. This is an entirely new departure for the War Office to take. If we credit this department with knowing all about military rifles, no matter how much we may differ about the manner in which the knowledge is applied, even the War Office itself must recognise that it knows nothing about cadet rifles. It has been suggested in connection with the recent sealing of the ·22 cartridge as a service pattern of ammunition that the War Office have done so upon the theoretical assumption that it is the invention of a remote individual in the North of England who happened to adapt a rifle to fire this calibre of rim-fire cartridge. Whether the Government have adopted the short, long or long-rifle cartridge we do not yet know, but there is always the fear that the intermediate length giving the smallest efficiency has been chosen. When it comes to adopting a cadet rifle the choice lies between obtaining the best available weapon for the purpose or selecting something inferior because it is cheap. In point of fact a good rifle must of necessity cost a certain minimum price. That a rifle fires a small cartridge does not make any material difference in the cost of production. Though the selling price of miniature rifles varies over a considerable range it is evident upon even a superficial examination that quality and cost are very closely related. If, as we believe, it is the desire of the War Office to endeavour to secure a miniature rifle for 30s. or 35s., we must at the outset confess that such efforts are likely to lead to disappointment. In the case of a service rifle the selection when made controls the rifle practice that takes place at the different ranges here and abroad. There may be other weapons which shoot better, but as the service rifle is the standard their use is barred except for the match rifle shot who is too much in the minority to be treated as a serious factor. With a miniature rifle the conditions will be quite different. No decision and no order can effectively disarm the competition of rival makes of rifle. Consequently if the weapon which may be adopted shoots worse than the best for any reason connected with the barrel, the breech mechanism or general handling, that fact will be known to everybody, and we shall occupy the impotent position of seeing our chosen infant labouring at a disadvantage against its more efficient rivals.

The mere advice that a thing should be made good is open to the charge of recommending theoretical perfection without pointing out the means for its attainment. We accordingly have no hesitation in laying down what appear to be the leading points of construction which differentiate the good miniature rifle from the bad. In regard to the barrel we must of course assume that this will be of the nominal ·22 calibre. Whether the actual decimal diameter shall be ·218, ·219 or ·220 must be determined by a host of experiments which will also have for object the selection of a suitable shape of rifling and rate of twist. Assuming again that the chamber must be of the long-rifle length it will be necessary to endeavour to ascertain whether it can be so made as to allow an unfired cartridge to be withdrawn, or whether we must adopt the objectionable and well-nigh universal practice of forcing the bullet into the lead so that extraction of an unfired cartridge can only be partially effected, in so far that the bullet is left in the barrel. This problem must of course be considered side by side with the construction of the cartridge. That is to determine whether the bullet can be necked into the case so as to prevent the cartridge from coming asunder even when drawn out unfired from the chamber into which it has been loaded. More than this the shape of the chamber and the angle of rifling must be carefully considered with regard to the possibility of arriving at a compromise, whereby short cartridges can be fired in long-rifle chambers, and give results proportionately as satisfactory as those obtained with full-length ammunition. Six months' hard labour is our own summary of the effort involved in satisfactorily solving this problem, and it can only be solved with the help of a suitable equipment of boring and rifling appliances. If the area of the research is to be still further enlarged time might well be devoted to ascertaining whether a smokeless cartridge could be produced which would combine in itself the advantages of the short and the long-rifle ammunition. On the basis of recent experiments which have come to our knowledge we firmly believe that the time is ripe for bringing out a new ·22 calibre ammunition specially adapted for short-range target practice, that is from 20 to 50 yards in the ordinary way with reasonably good shooting at 100 yards. A much-needed improvement in the ammunition is to flatten the nose of the bullet and so give large and clean perforations of a kind which would be easy to spot with a telescope and be more satisfactory in regard to determining the score value of a series of shots.

We may now dismiss the barrel, having shown that our requirements will be met by something which will give a high standard of shooting. In the matter of sights it is of course obvious that a miniature rifle having the general dimensions of a walking stick will be quite out of place. The War Office must insist on the use of open sights with a notch and barleycorn similar to those on the service arm. As the efficiency of open sights is quite as much controlled by their position as their shape, it is a *sine quâ non* of the cadet rifle that when laid on a table side by side with the service rifle the trigger, the backsight and the foresight shall be placed relatively with one another in substantially the same position, That the backsight must be capable of minute adjustment, both vertically and laterally is now so widely recognised that we need not labour the point. If the shooter requires to alter the angle of his fire by an amount representing half-an-inch at 50 yds. his sights must be capable of doing it with certainty. Our specification of the barrel and the sights necessarily determines the length of the rifle. The weight follows by due inference, and all that need be said under this heading is that the closer it approaches that of the service rifle the better it must be. We place the limit at 8½ lbs., and if well proportioned the rifle should balance well enough for ordinary work, always provided that the weight is disposed on the opposite principle to the ideal conditions quoted by us last month from the recent article by Major Wallace. As regards the trigger and mechanism generally we have no desire to urge any definite views. All that is wanted is an efficient single-shot action which will eject the empty cartridge case, and afford an easy means of inspecting and cleaning the barrel.

VISIT TO CONTINENTAL TESTING STATIONS.

In continuation of our notice of the report issued by Captains Lloyd and Desborough concerning their continental tour of inspection, we give the following list of stations visited at which safety mining explosives are tested:—

	Place.	*In charge of*
1.	Frameries.	*M.* Victor Watteyne and *M.* Simon Stassart.
2.	Grube Maria	Herr Stegemann.
3.	Haltern.	Westfälische-Anhaltische Sprengstoff A-G.
4.	Schlebusch.	Dynamit A-G.
5.	Schlebusch.	Carbonit A-G.
6.	Gelsenkirchen.	Herr Beyling.
7.	Castrop.	Castroper Sicherheits Sprengstoff A-G.

In Belgium the function of the testing station at Frameries is similar to that at Woolwich. Only those explosives which have passed the tests are permitted for use in mines in which firedamp or inflammable coal dust has been found. In Germany the law prescribes that only "safety explosives" shall be used in mines in which firedamp or inflammable coal dust has been found. The onus of proof as to what constitutes a safety explosive rests with the mine owners. Testing stations 2 and 6 in the above list were constituted for such tests. The private station at the various factories have no judicial position. The following summarises the observations made:—

1. *Means Employed to Mix the Gas and Air.*—With the exception of the installation at Frameries, the methods adopted for mixing the gas and air seem very crude, and it is difficult to believe that a high standard of uniformity can be obtained. The results of our experiments at Woolwich appear to indicate that in the case of coal gas mixtures the sensitiveness to ignition increases with the percentage of gas up to a point slightly above the percentage giving the maximum explosiveness. One may fairly assume that a similar phenomenon will appear with methane.

2. *The Invariable Use of No. 8 Detonator.*—A No. 8 detonator was always used to fire a charge, and was invariably placed in the front cartridge. This position of the detonator must, we imagine, be more favourable to the explosive, inasmuch as it would be more likely to ensure the complete detonation of the front cartridge, which itself would act as a sort of tamping for the remainder of the charge. So far as we could ascertain, there was no legal requirement which insisted that this size of detonator should always be employed in practical use.

3. *Material of the Cartridge Wrapper.*—As regards the nature of the wrapper used, we have had ample proof at Woolwich that this is a matter of practical importance, as several explosives which have failed to pass at the first trial have been successful when the material of the wrapper had been altered.

4. *Regularity of Detonation of Individual Charges.*—The object of our requirements that the charge shall be completely detonated at each shot fired during the test, is to ensure that the explosive shall be fired in such a manner as to develop its maximum amount of heat, and so afford the conditions under which it is most likely to ignite the gas. If this requirement were omitted, it would be possible for an explosive to pass the test through being only partially exploded, which, had the detonation been complete, would have fired the gas. The grounds upon which the minimum size of a detonator is specified for actual use are different. We have held that it is possible for an explosive to be set on fire by an insufficiently powerful detonator, and that in this eventuality it would be possible for burning particles of explosives to be projected into the gas; if, however, the charge is completely detonated, the whole of the explosive is practically decomposed into its final products simultaneously.

5. *Effect of Air-Spacing.*—Contrary to the results of our experience the air-spacing of the charge is considered as being quite unimportant. It seems probable, however, that a diminution of the gravimetric density must tend to a proportionate diminution of pressure, and therefore to the rate of detonation.

6. *The Use of Coal Dust.*—Although coal dust was almost invariably used, we were always told that its presence did not increase the sensitiveness to explosion, but merely added to the violence and visibility of the ignition. The use of freshly ground dust removes one of the objections which we have always had as to the inclusion of coal dust in the official test, but the other objections remain unaffected, and its employment does not appear to serve any useful purpose. It is to be remarked that Frameries affords the most sensitive test of those which we saw, and there no coal dust is used.

7. *Substitute for Natural Gas.*—So long as our testing station remains at Woolwich, the use of natural pit gas is quite out of the question, and the results obtained at the private testing stations in Germany where coal gas, benzene and artificial methane are used in direct comparison with other stations using natural gas, are very reassuring as to the value of experiments made with coal gas or other substitutes.

The explosion temperatures of methane and coal gas are given by Dr. Von Schwartz as 656 deg. to 678 deg. C. and 647 deg. to 649 deg. C. respectively, and the range of explosibility as from 5 to 13·16 per cent. for methane and 8 to 23 per cent. for coal gas. We have not confirmed these figures, neither are we able to say whether those given in the case of coal gas would apply equally to the gas which we have at Woolwich; but so far as the figures go they may be taken as showing that there is no very wide difference between the relative degrees of sensitiveness to explosion.

8. *The "Charge Limité."*—We were considerably impressed with the principle involved in the adoption of the *charge limité*. It affords a most useful object lesson to miners as to the increasing danger due to larger charges. The explosion of a definite quantity of a given explosive evolves a definite quantity of heat, and as the weight of charge is increased, so a proportionate increase in the evolution of heat takes place, and it has been proved experimentally that there is for each explosive a certain maximum weight which will ordinarily fail to ignite an explosive atmosphere. *Charge limité*, M. Watteyne's name for this maximum weight, is a useful term, for which we have no equivalent in the English language.

To determine the *charge limité* by firing stemmed shots is quite impracticable, as even the relatively small charges used for our test do not admit of our guns being used for more than about eighty rounds without being relined. Without stem-

ming the wear and tear is enormously reduced, and we were shown the section of a liner which had fired more than a thousand shots, which did not show as much erosion as one of our guns would after having fired sixty shots. The firing of unstemmed shots in our present gallery is impracticable, as all explosives ignite the mixture, except with charges of only a few grams. It may also be noted that the first cost of the continental gun is less than half the cost of ours.

9. *Firing Shots without Stemming.*—The chief objection to the use of unstemmed shots, and one which is admitted on the continent, is that the explosive is being fired under conditions which should never obtain in a mine. There seems ground for suspecting that an explosive forms different decomposition products under varying conditions of pressure, and, therefore, that different phenomena result when an explosive is fired, either under relatively complete confinement, as in a stemmed shot hole, partial confinement, as with an unstemmed shot, or under atmospheric pressure, as when hanging freely in the gallery. With the present condition of our knowledge it is not possible to prove or disprove these theories, but they must be considered at least as not improbable.

On the other hand, the absence of stemming is one of the most dangerous circumstances attending shot firing, and one which, while unlikely to occur in actual practice, is approached by the conditions of—(1) Insufficient or unsuitable stemming, (2) over-charging, and (3) firing in holes in which there is a blower of gas or which communicate with fissures in which there may be an explosive mixture. Of these three conditions the first two may be avoided only by the employment of none but ideally perfect miners; the third condition is one which appears to be by no means uncommon, and against which it is also practically impossible to guard. These conditions are all specially prejudicial to the safe use of *slow* explosives, and we believe that it is on these grounds that their use has been specifically prohibited in fiery and dusty mines on the continent.

It is to be observed that when a shot hole is overcharged with a non-brisant explosive, there is a considerable risk of the explosive being projected into the atmosphere of the mine whilst still burning. This condition is not met by our test, nor could it be met by any modification of it, except that of very largely increasing the charges, a course which could not be adopted. It appears to us that there is no practical way in which it can be met, other than that of firing unstemmed shots.

As will be seen from our record of ignitions of firedamp, no less than fourteen ignitions out of a total of twenty-two which have occurred during the past five years, were caused by explosives of this type, which have passed our present test as modified in 1899. Should the firing of unstemmed shots be included in our official test, we should incidentally obtain two advantages, namely, the firing of heavier charges and a largely diminished expenditure. With unstemmed shots it would be possible to fire experimentally charges of explosives equal to, if not greater than, those ordinarily fired in the mines, thereby obtaining more knowledge of the possible dangers attaching to the firing of the maximum charges in ordinary practical use. The question of cost has already been discussed in (8). It is not unreasonable to expect that this reduction of cost would induce manufacturers of *brisant* explosives to erect testing stations, and carry out researches tending to the acquisition of further knowledge of this difficult subject and the improvement of their products. That this is not an over sanguine expectation is shown by the valuable work done at private testing stations erected by manufacturers of explosives in Germany.

10. *The Dimensions of the Galleries.*—It is difficult to solve the problem presented by the apparent paradox that at Woolwich extremely small charges of any explosive when unstemmed suffice to fire the gas, whereas on the continent large charges fail to do so.

The nature of the gas used by us has, apparently, not so great an influence as has been generally considered to be the case, as at two of the testing stations which we visited the use of ordinary lighting gas has proved no obstacle to firing unstemmed shots. The only other material variation lies in the differences which exist in the dimensions of the explosion chamber. According to Professor Bunte, of Carlsruhe, the the limits of explosibility of a gas mixture can be greatly varied by circumstances, such as the lateral dimensions of the containing vessel, the method of ignition, volume of gas present, moisture content of the same. This is fully borne out by the experience at Schlebusch Carbonit-Fabrik, where they have galleries on the English and German patterns side by side, and under identical conditions, except as to dimensions and use of stemming.

From the experience of the Schlebusch Dynamit-Fabrik; to which we have already alluded, it would appear that an increase of the length of the explosion chamber has the effect of diminishing the sensitiveness of the test, so that the important factor appears to be the diameter. The sensitiveness would seem to vary roughly, therefore, inversely as the sectional area of the gallery.

The primary object of our testing station is to enable an empirical line to be drawn between such explosives as may, and such as may not, be used in mines to which the Explosives in Coal Mines Orders apply; or, in other words, to eliminate the more dangerous explosives from those used in fiery and dusty mines. It is impossible in any single test to reproduce all the varying conditions which may be met with in practice; indeed, many of these conditions for physical causes cannot be reproduced. The utmost that can then be attained is, by means of an empirical test, so to draw the line as to afford a reasonable freedom from ignitions of gas and dust in the mine.

In furtherance of the policy of holding miniature rifle meetings in different parts of the country the Society of Miniature Rifle Clubs held a very successful meeting at Caerleon, Monmouthshire. The standard of shooting that obtained was very high, but this was not so much due to the skill of the local riflemen as to that of the visiting teams of the South fields and Twickenham clubs. The somewhat mortifying experience of seeing the leading prizes going to outsiders will do much to stimulate local shooters to greater efforts in the future. The meeting which is due to be held at Derby on the 7th inst. will doubtless serve a similar purpose, for it is generally considered that the Midland Railway Company's club is inclined to study cheapness of supplies before efficiency. In miniature rifle shooting such economies are bound to prove expensive in the long run, and no better means of conviction could be imagined than a sound footing by visitors who regard accuracy as the prime consideration to study.

CONTINENTAL DOINGS.

Belgian Permitted Explosives.—Recurring to the paper of M. Watteyne and M. Stassart before the Liége Mining Congress, quoted last month, the official tests at Frameries reduced to eleven the number of safety explosives permitted in fiery mines. They are as follow:—*Kohlencarbonite* (nitroglycerine 25, potassium nitrate 34, wheat flour 38·5, barium nitrate, ground bark 1, soda 0·5). *Securophore III* (nitroglycerine 25, potassium nitrate 34, barium nitrate 1, sodium bicarbonate 0·5, rye flour 38·5, wood meal 1). *Densite III* (trinitrotoluol 4, ammonium nitrate 72, sodium nitrate 22). *Dynamite antigrisouteus V* (nitroglycerine 44, sodium sulphate 44, wood meal 12). *Grisoutine II* (nitroglycerine 44, sodium sulphate 44, wood meal 12). *Carbonite II* (nitroglycerine 30, sodium nitrate 72·5, wheat flour 40·5, potassium bichromate 5). *Favier II* bis (dinitronaphthalene 2·4, ammonium nitrate 77·6, ammonium chloride 20). *Poudre Blanche Cornil I* bis (ammonium nitrate 77, potassium nitrate 1, dinitronaphthalene 3, lead chromate 1, ammonium chloride 18). *Ammon-carbonite* (ammonium nitrate 82, potassium nitrate 10, wheat flour 4, nitroglycerine 4). *Grisoutite* (nitroglycerine 44, magnesium sulphate 44, cellulose 12). *Securophore II* (nitroglycerine 36·36, nitrocellulose 0·91, ammonium nitrate 24·55, potassium nitrate 3·64, sebacic acid 11·36, rye flour 9·09, wood meal 1·82, liquid hydrocarbide 3·18, sodium chloride 9·09.) The following table gives (A) the maximum permitted charge in grammes of the above named explosives; (B) the equivalent in grammes of dynamite to the maximum permitted charge; and (C) the cubic metres of rock brought down by the maximum charge, 1·07 oz. being equivalent to 30 grammes and one cubic metre being 1·3 cubic yard:—

Permitted Explosives.	A grammes.	B grammes.	C cu. met.
Kohlencarbonite	1,100	612	2·530
Securophore III	1,050	676	2·839
Densite III	900	398	1·672
Dynamite antigrisouteus V ...	850	470	1·974
Grisoutine II	850	443	1·861
Carbonite II	750	457	1·919
Favier II bis	700	410	1·722
Poudre Blanche Cornil I bis...	700	427	1·793
Ammon-carbonate	600	381	1·600
Grisoutite	500	297	1·247
Securophore II	450	333	1·399

Conclusions Drawn from the Tests.—Among the conclusions that M. Watteyne and M. Stassart consider themselves warranted, for the present, in drawing from the stringent tests at Frameries, are the following:—The vaporisation of a certain quantity of water or the gasification of a volatile substance at the moment of explosion, influences the safety of explosives. The differences noticed as regards the ignition or non-ignition of an explosive mixture by the same substance, detonating under the same conditions, can only be attributed to want of regularity in loading the cartridges. The calculated temperature of detonation, although constituting a valuable element of investigation, cannot alone measure the degree of safety. The safety of an explosive does not depend upon its chemical composition alone, but also on the method of its manufacture. A wad of moderate thickness, slightly rammed, greatiy increases the degree of safety, this influence varying within large limits with the nature of the explosive. The amounts of the maximum charges of the above-named permitted explosives afford means of meeting all the requirements of mining practice.

Cockerill Cannons at the Liége Exhibition.—The Société Anonyme John Cockerill shows on its large stand in the machine hall of the Liége Exhibition a rapid-firing cannon of 120 mm. (4·7 in.) bore on fixed carriage with hydraulic brake; a rapid-firing field mortar of the same bore on carriage with long recoil, and another also of the same bore with hydraulic brake and cupola; a rapid-firing nickel steel field cannon of 75 mm. (3 in.) bore with long recoil carriage and also with shield and hydraulic brake; a coast or marine gun of 57 mm. (2·25 in.) bore with shield; a rapid-firing cannon of 57 mm. (2·25 in.) bore, mounted on an embrasure carriage, a breech-piece for cannons of 150 mm. (6 in.) and 75 mm. (3 in.) munitions and munition cases; armour plates and the projectiles that have tested them; various forgings for cannons and their carriages, and a sapper's shield of chrome-nickel-steel, proof against rifle balls even fired from a short distance.

Gratis Shooting Accident Insurance.—M. P. Flobert, of Paris, whose name is synonymous with "carbine" on the continent, and whose gun business dates from 1844, offers a gratis insurance policy against shooting accidents on receipt of the first order for 2,000 cartridges from each new customer.

Sporting Maxims.—With the opening of the shooting season the *Gaulois* recalls the following advice to aim high from a rare brochure entitled "La Chassomanie," published by Delahays in 1856;—

> Le grand défaut, c'est de tirer dessous;
> En s'éloignant, jamais l'oiseau ne baisse,
> Et dans son vol il s'élève sans cesse,
> Vous tirez bas, alors qu'espèrez-vous?
> Le faisan monte, il faut le tirer haut,
> Poindre la queue est le commun défaut.

This obviously applies to birds shot over dogs. If the poet wrote to-day he would emphasise the fact that at driven game the common error is to aim behind the bird through underestimating the pace of its flight.

Small Balloons as a Mark.—During his recent visit to Ostend the Shah of Persia showed his shooting capabilities by bursting small balloons, like those given to children at the Magasins du Louvre, instead of firing at real or clay pigeons.

French Artillery.—The opinion quoted in a July note that, as regards artillery, France is now ahead of other nations, is shared by General H. Langlois, former member of the Conseil Supérieur de la Guerre, who observes in the *Revue Bleue*:—"Notre artillerie de gros calibre n'a rien à envier. . . . . Notre matériel de campagne est au moins aussi bon . . . et nos artilleurs conserveront . . . la supériorité . . dans le maniement et l'emploi si délicat du canon à tir rapide."

Automobile for Explosives.—The Paris Municipal Laboratory possesses a motor-car specially equipped for the removal and conveyance of explosives. At the rear end is a chest, armoured and lined with asbestos wool, for receiving the explosives to be conveyed. Precautions are taken to avoid heating, the working parts being arranged at the front end, as far as possible from the chest. The exhaust chamber is lined with asbestos.

ROUND THE TRADE.

The next gun sale by Messrs. Debenham Storr & Sons is fixed for the 17th inst.

The Wilkinson Sword Co,. have lately issued two excellently printed lists, the one dealing with guns and rifles, and the other with revolvers.

We very much regret the news which reached us early last month to the effect that Mr. Charles Hellis, gunmaker of Edgware Road, died on the 5th ult.

Mr. A. H. Gale has been appointed a director of Westley Richards & Co., Ld. This is a fitting recognition of a strenuous lifetimes' devotion to the interests of his firm.

The Stevens Arms Co. recently offered prizes for the purpose of obtaining a name for a new rifle they will shortly introduce. As a result of considering 36,768 names the appellation "Little Scout" has been selected as worthy of premier honours.

The English edition of the Savage Rifle catalogue which has just reached us contains particulars of a new single shot rifle of inexpensive design which is a marvel of value for the small price charged. It is fitted with an open backsight capable of screw adjustment both vertically and horizontally.

The Morris Tube Company have issued a notice to the effect that practice tubes for Martini-Henry rifles and carbines are now out of stock, and will in future be supplied to order only, price 30s. each. The price that previously ruled was 25s. The trade discount is liberal and varies with the number of tubes brought.

That concentration on the work in hand is the essence of success in shooting was lately exemplified at a shooting school near London. After missing a clay bird the shooter opened his gun and taking out his tobacco pouch proceeded to charge the empty chamber with straight cut. The moral of this story is clearly that if the mistake had passed unnoticed the gun would have been blamed for want of success all the while that the shooter was himself in the wrong.

Messrs. Ludw. Loewe & Co., of 30-32 Farringdon Road, E.C, have forwarded to this office their price list and particulars of D.W.M. standard ball-bearings. This simple little contrivance is working well-nigh a revolution in many industries. The ordinary bearing of a shaft is fitted with one of these finely fitted rings, following which friction and wear are virtually eliminated. They are made in a variety of sizes to suit a wide range of loads and speeds.

Mr. Oscar Guttmann announces the publication of a book giving facsimile reproductions of various ancient pictures and engravings taken from the originals in libraries in different parts of the world. The subject to be treated is the early manufacture and use of gunpowder, a department of explosives research on which the author's wide experience entitles him to speak with authority. Subscriptions are invited for the limited edition which will be printed. The absolute number of copies to be put into circulation is not stated; but judging from the technical description of the general get-up and binding of the book we are led to expect that a large amount of time and money will be devoted to ensuring good results.

That there is at least one Irishman in the gun trade is shown by the following extract from a recent advertisement in the *Field*:—"The ejectors are the 'Deeley' system of ejector, which is a long way the best and do (*sic*) not get out of order, and if they do they work as an ordinary gun." On the same lines the Scottish, not the Irish, representative of the *Shooting Times* also scored a bull in the following manner:—Speaking of Smokeless Diamond with a 33-grain charge and one ounce of shot he quotes it as giving a chamber pressure of 3·21 tons per square inch, a recoil of 22·14 ft-lbs., a time up barrel of 00·30 sec. and a mean velocity of 1070 feet per second. After enlarging on the clean killing properties of this powder and its sharpness of action he concludes with the words "besides it has no recoil."

Owing to the completion of special work at the National Explosives Company's Works a reduction in the number of hands employed has followed. This is an unfortunate matter for the Hayle district, which was affected some time back by the engineering and shipbuilding works of Harvey & Co. being greatly restricted in their operations. A large amount of this surplus labour was absorbed by the National Explosives Works, where nearly 800 men and girls have been engaged. These works cover an extensive area on the towns near Gwithian, and in recent years have been the principal industrial concern in the district. With the gradual expansion of the works thousands of pounds were expended in the erection of new houses, especially at Connor Downs. Orders from the Government decreased considerably some months ago and the Company has for this reason it is understood been compelled to cut down the number of its employees.

The report of Sir W. G. Armstrong, Whitworth & Co., Ld., for the year ended June 30th last states that, after deducting depreciation and adding £86,369 from last year, there remains a profit of £580,927 on the last year's operations. It is proposed to declare on the ordinary shares a dividend of 3s. per share, free of tax, of which 1s. per share has been already paid as interim dividend. This leaves now payable a dividend of 2s. per share, which, with the usual half yearly payment on the preference shares, will absorb £496,849, leaving a balance of £84,033, to be carried forward. The directors report that the establishments of the company are well supplied with orders. In continuance of past policy, the sum of £150,000 has been placed to the credit of the account for the renewal of plant. The directors have decided that the comparatively small sum in the books of the company representing goodwill should be eliminated. They have therefore applied the sum of £137,120 to this purpose, and the goodwill is now extinguished.

J. B. L. writes:—People who use Fluor oil should be careful not to leave the fluid exposed to the air more than necessary and the bottle should always be kept well closed. The reason for these precautions is that caustic akalies have a very strong affinity for carbonic acid gas which they absord readily from the air. If they are left exposed for long in aqueous solution they lose much of their akaline quality, while imbibing CO_2 from the surrounding atmosphere. The detergent and protective qualities of the fluid when used for cleaning out a fouled barrel will necessarily be diminished if it is already partially charged with carbonic acid gas. If by any chance the fluid should be left exposed to the air until it has gorged itself with carbonic acid under ordinary atmospheric conditions then not only will it not be able to take up and neutralize the free carbonic acid in the fouling but it may even add to the quantity of free CO_2 already there. This is because the nitros and nitric acids in the fouling will have a stronger affinity for the alkali than carbonic acid has, and an equivalent of CO_2 will be expelled from the alkaline combination.

The directors of the Birmingham Small Arms Co., Ld., in their annual report state that there is a trading profit of £78,568, which with interest on investments (£2,515) and the amount brought forward from last year (£1,883) places at disposal the sum of £82,967. Full allowance has been made for depreciation. Interim dividends of 5 per cent., free of income tax, on the ordinary shares and 2½ per cent on the preference shares were paid on April 1st. The directors now recommend a final dividend on the ordinary shares of 5 per cent (making 10 per cent. for the year), together with a bonus of 5s. per share, free of income tax, and on the preference shares of 2½ per cent. These payments amount together to £55,358. The directors further recommend that a sum of £20,000 be carried to the reserve fund, which will then stand at £60,000. This will leave £7,609 to be carried forward. The Government order for the new service rifle, referred to in the last report, has been satisfactorily completed, and the gun department is now engaged on a further contract. The demand for the cycle component parts manufactured by the company has very considerably increased, in spite of greater competition, and the directors have every confidence that this department will continue to provide a large proportion of the profits.

UNUSUAL SPORTING CHARGES.

So much attention has been paid during recent years to the standardisation of smokeless powder charges that the working out of useful combinations outside the usual limits has been somewhat neglected. If we take the *Sporting Goods Review* loading card which has just come to hand it will be found that very few makers have laid themselves out to specify charges outside the usually accepted limits. It cannot be denied that sporting opinion demands special charges for special kinds of work, and it is a sevére tax upon the skill and experience of the cartridge loader to find out for the loading of an odd hundred or so cartridges the best possible combination of wadding to adopt. If powder makers could agree amongst themselves concerning a legitimate series of variants from ordinary loading, measures might be taken to specify once and for all the wadding that should go with such charges.

Canada takes millions of cartridges containing so much shot that the thickness of the felt is cut down to one-eighth of an inch. Wildfowlers again adopt the ounce-and-a-quarter load in the ordinary length of case. To execute an order of this kind must place the loader who is unused to such vagaries in a quandary as to how he shall harmonise the apparently impossible requirements of his customer. The danger always exists that the powder may be unduly compressed so as to make room for the usual allowance of felt wadding, the result being as unsatisfactory to the user as to the reputation of the powder maker. It necessarily happens that many charges are used which must be unfavourably regarded by the expert who alone realises the badness of a given combination. A half-way policy might nevertheless be adopted by the powder trade towards these eccentricities. If a shooter really requires a duck or rabbit charge for a 2¾ in. case to kill at sixty yards there is no reason why the combined skill of powder maker and cartridge loader should not be directed towards specifying the most favourable conditions of loading. It would of course be understood that the charges so laid down are not necessarily recommended by those responsible for framing the loading instructions. On the other hand the ordinary card of directions lacks information on the very points where ordinary experience most often needs to be supplemented.

The shooter who would use 1 1/8 oz. of No. 3 shot for wild duck is hardly likely to appreciate the importance of reducing the powder charge so as to diminish velocity and improve pattern. The very smallness of the number of pellets necessitates the taking of special measures for checking the natural spread of the charge. This can best be effected by a 5 per cent. diminution of powder. The penetration would still be all that is required by reason of the extra heavy weight of the individual pellets. In like manner the loading of a snipe cartridge involves many considerations which make the analogy provided by the ordinary sporting cartridge an unsuitable source of guidance. The smallness of No. 10 shot makes it pack into the case with exceptional closeness. If the resulting surplus accommodation is filled with felt wadding the naturally high pressure produced by a small charge of shot is still further accentuated. Pattern is spoilt and the recoil becomes considerable. Such a cartridge seems necessarily to involve the use of a reduced weight of shot charge accompanied by the employment of feltine wadding with a view to filling a certain proportion of the available space without unduly influencing the activity of the powder. The velocity might still be above the normal, at any rate near the muzzle, so promoting a sufficient spread at the shorter distances to increase the proportion of successful right-barrel shots.

The rabbit cartridge might again be made the subject of consideration. Shot sizes 3 and 4 should be regarded as specially suitable in such a connection. Some shooters may from experience prefer exceedingly light charges for ferreting, whilst others who stroll round the hedgerows for sitting shots might require a different specification. A carefully-selected series of combinations might easily be prepared, so supplying the necessary latitude for selection. For each charge the needful combination of wadding might be stated, also the class of work for which it is specially fitted. To the gunmaker the official recognition of a number of variations from the practice adopted for stock loads would doubtless represent a highly-welcome development. The fact that such cartridges could not very well be kept ready loaded would throw in his way many special orders of a kind likely to represent a useful addition to the ordinary run of business. The unpopularity in many trade quarters of fantastic combinations of charge no doubt arises from the great loss of time which is involved in determining the best system of loading for each order. If, on the other hand, the more usual variations could be specified in a loading chart, sportsmen would no doubt soon accustom themselves to the idea of confining their attention to the special charges which have received the sanction of publication, and which are thereby known to have formed the subject of careful investigation.

The *Sporting Goods Review* loading card, by reason of the care with which it is yearly compiled, occupies an important and influential position in the trade. The very fact of issuing such a card is gradually making it less and less necessary as the years go by. That is to say the differences between powder and powder are gradually disappearing until now 90 per cent. of the nitros loaded in this country could be dealt with by a simple statement of loads according to the groups to which they belong, viz., the 42 and the 33-grain classes respectively. The very compactness of tabulation which would follow from this simplification of method would open the way to supplementing the present usefulness of the card by including within its scope the various special charges of which only a few examples have here been sketched out. It might happen that the powder makers would not at first feel inclined to attach official sanction to some of the more marked abnormalities. It would, however, be quite sufficient for a start if special charges could be defined and issued without any implied guarantee. A little experience in their use would soon bring to light any defects which might have escaped attention. Little by little the more useful amongst these combinations would become known, and they would gradually find their way into the inner sanctum of recognised loads. It is not, of course, suggested that this somewhat novel departure from the existing custom of the trade should be adopted with undue haste. A considerable amount of time would be involved in carrying out the incidental tests that would be necessary. The prime intention should be to condense into as small a series as possible the more useful variations from the recognised standard charges.

RIFLE BARREL STEEL.

By F. W. JONES.

IT will no doubt be admitted on all sides that our information of no subject has increased more than that of steel during the last 25 years. This addition to our knowledge has not affected in equal measure the kinds and qualities of iron products, although it has done much to induce developments in this direction and it has furnished in most instances an explanation of the known properties of iron and its alloys.

The steel used in the construction of guns has certainly not been improved to the extent one might expect from the great advance made in other departments of the steel industry. One illustration will be sufficient to prove this, viz., our Government specification for Ordnance steel has for many years only asked for an ultimate tenacity of 34 tons with elongation of 15 per cent. When one realises that an increase in the strength of steel allows the adoption of gunpowder charges giving pressures increased in the same proportion, the importance of using steel of great tenacity will be at once apparent. This point might with advantage be further enlarged. For instance, suppose it were possible to use steel in the construction of ·303 rifles of a tenacity 50 per cent. greater than that at present adopted, then the safe working pressures might be raised from 17 tons to 25½ tons. Assuming that the brass case and Lee action would stand this higher pressure then, without altering the case or bullet, cordite could be loaded to give 27 per cent. higher velocity than the present observed 2,000 f.-s. From this it is obvious that the strength of the steel used in gun construction limits the velocity possible in any combination of bullet and powder.

Scientific gun construction should not only take into account the nature of the steel used but also the disposition of the metal, having regard to the pressures developed all along the barrel by the explosive charges used. In many instances barrels are as unnecessarily weak in some parts as they are strong in others, this without any special justification. If barrels must be made of a certain weight to absorb the recoil, there is no reason why the metal of the barrel should not be arranged to give the greatest safety when balance and rigidity are satisfied. This is not done because gunmakers ignore the *a priori* methods of arriving at the permissible pressures in guns from a mistaken belief that the calculated figures are not real. Experiments in barrels constructed from steel of known strength with cartridges giving known pressures, prove that this is not correct, in fact permanent sets are developed in gun-barrels whenever the elastic limit of the barrel steel is sufficiently exceeded to show a measurable set.

This point is worth understanding. One can easily measure an increase in the diameter of chamber or bore of ·001 inch. This increase in diameter is equivalent to a circumferential increase of ·003 inch, and when it is remembered that the outer layers of the barrel are not strained so much as the inner, and that they therefore compress the latter after the stress is removed, it is at once obvious that the inner layer has been stretched more than ·003 inch beyond the elastic limit. Consequently, when a permanent set is produced in a rifle barrel the inner layer has been strained considerably above the elastic limit. This must be taken into consideration when practice and theory are compared. For instance, let us consider a ·450 straight express rifle barrel with an external diameter over the chamber of 1·15 inches. If made of steel having an elastic limit of 35 tons and an ultimate tenacity of 55 tons, one would expect it to be enlarged when the inner layer is put under a stress between 33 tons and 55 tons. Actual test with a barrel made from such steel gave a chamber set when the stress on the inner layer was 46½ tons. Examples of this nature might be multiplied, but it may suffice to say that experience proves rifle barrels do take a permanent enlargement when the gunpowder pressures put a stress on the inner layers somewhere between the elastic limit and ultimate tenacity of the material from which the barrel is made.

Because rifles do not give way as soon as the elastic limit of the barrel steel is exceeded, it has been argued that it does not matter if these high pressures are allowed in such rifles. This is absolutely unsound. In the first place, to produce a permanent set in a rifle robs the barrel steel of part of its ductility. If it is wise, and there can be no doubt about it, to specify a minimum elongation to rifle steel, it is obviously wrong to reduce this ductility by raising the elastic limit and increasing the hardness by overstrain. There is a still more serious objection, and that is the development of planes of weakness by so-called fatigue. The repeated application of a load undoubtedly affects the material strained by an amount depending on the range of the applied stresses, and when such material does break down by a load inferior to the ultimate strength, generally the broken pieces do not show any decreased strength or elongation in the testing machine. The explanation is rather hypothetical, but then it certainly fits in with practice, viz., the repeated straining of a metal picks out weak spots and develops them until the material breaks, without elongation, from brittleness of a very local nature. If this view is correct, then the steel for rifle barrels should never be strained above the elastic limit either in proof or in use. To accomplish this steel of a high elastic limit should be sought, the thickness of the barrel being arranged, having due regard to the normal gunpowder pressures likely to exist at any time in the barrel.

It is proposed in this article to consider rifle steel from two aspects only, viz., that of barrel thickness and the physical properties of the material of which the barrel is made. The relation between the pressures in a rifle barrel and the strains set up in the steel will be found in many treatises on the subject. It will be sufficient for our purpose if the formulæ accepted by authorities alone is quoted. When account is taken of the compression of the material radially as well as the hoop tension, the following relation can be obtained:—

$$P = \frac{3}{4}\frac{(d^2 - r^2)}{d^2 + 2r^2} \times t$$

Where P = Powder pressure.
t = stress on inner layer of barrel.
d = outer radius of barrel.
r = inner radius of barrel.

When a point inside the cartridge chamber is considered, the effective powder pressure is less than the real, because it acts at a radius less than r, viz., that inside the case. Thus P becomes $p = \frac{r_1}{r}$ P where r_1 is the internal radius of the case.

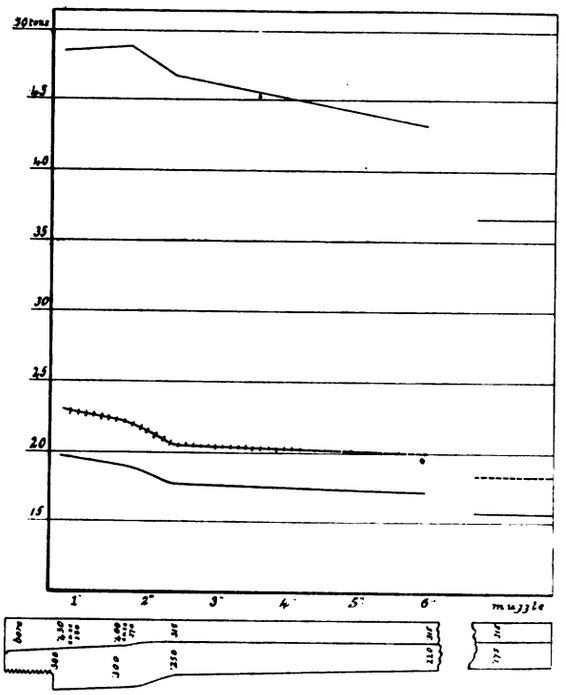
The above expression is quite accurate for determining the

pressure which will over-strain a barrel or the allowable pressure for any value of t; but if it is desired to find the pressure which will burst a barrel, then a different rule applies, and the expression for obtaining the bursting pressure is

$$P = \frac{3(d - r)}{d + 2r} \times T$$

Where T = the ultimate tenacity of the barrel steel.

In this relation the assumption is made that when the stretch is great, as it would be just before bursting, all parts of the barrel's wall exert an equal hoop tension.



Curves for the service rifle, with relation to the gas pressure at different parts of the barrel. The top curve shows the bursting pressure for a tenacity of 45 tons. The broken line curve the maximnm working pressure for an elastic limit of 35 tons, and the bottom curve the maximum working pressure for an elastic limit ot 30 tons.

To illustrate the application of these formulæ we have taken the section of an old ·303 rifle, and set out the maximum pressures which would just over-strain a steel of given tenacity and also the bursting pressures. The steel has been assumed to have an elastic limit of 30 tons and an ultimate tenacity of 45 tons. A third curve, the broken line, shows the increased allowable pressure when the elastic limit is 35 tons. This indicates a means for increasing the ballistics or affording a greater factor of safety. It must be understood that pressures higher than those termed the maximum working pressures would set up strains in the metal of the barrel, increasing the bore and reducing the ductility of the metal in proportion to the amount above the curve, also that the barrel would be bulged and rendered useless by pressures much inferior to those specified as the bursting pressures.

From this diagram it will be seen that a steel having an elastic limit of 30 tons is strained up to this limit by a chamber pressure of 17¾ tons. To increase the outside barrel diameter $\frac{1}{10}$-inch would add very little more than one ton to this figure, whereas the use of a steel of five tons higher elastic limit adds about three tons to the allowable pressure. Obviously the strength of the steel has a greater influence than mere thickness of wall. Therefore the nature of the barrel steel is of paramount importance.

The term steel is applied to widely different materials. Although iron may form over 95 per cent. of the mixture, the other ingredients have an important effect on the characteristics which for barrel steel may be defined as elastic limit, ultimate tenacity and ductility.

Carbon steel generally used in gun construction lies between the following limits:—

Composition.

Carbon	0·3 per cent.	to 0·5 per cent.
Manganese ...	0·5 ,,	,, 0·75 ,,
Silicon	0·05 ,,	,, 0·3 ,,
Sulphur	0·02 ,,	,, 0·05 ,,
Phosphorus ...	0·02 ,,	,, 0·05 ,,

Characteristics.

Elastic limit ...	20 tons to 30 tons.
Ultimate tenacity...	35 ,, ,, 45 ,,
Elongation ...	25 per cent. to 15 per cent.

This style of steel is generally adopted by gunmakers.

A slight variation from the above is made with great success by a manufacturer on a large scale. A sample which passed through our hands recently proved on analysis to lie between the above limits except as regards manganese, which came out at 1·18 per cent. This variation showed itself on testing, it was found that the elastic limit was 32·0 tons, ultimate strength 57·8 tons, and stretch 17 per cent. These improved results are probably not due entirely to the slight difference in composition. The treatment and care in manufacture account for a great deal in the nature of steel.

Messrs. William Jessop & Sons, of Sheffield, have placed in our hands some very interesting results of steels of their manufacture, which are tabulated below:—

	Gun Barrel Steel.		5 % Nickel Steel.		A Special Steel Alloy.	
	As Rolled.	Annealed at 680° C.	As Rolled.	Annealed at 700° C.	As Rolled.	Annealed at 700° C.
Elastic Limit ..	29·2 tons	24·4 tons	41·0 tons	34·0 tons	41·6 tons	32·0 tons
Ultimate Stress ..	57·2 ,,	45 8 ,,	61·6 ,,	50·0 ,,	58·0 ,,	48·0 ,,
Elongation	11·0 %	18·0 %	13·0 %	25·0 %	23·0 %	30·0 %
Contraction	30·5 ,,	48·0 ,,	16·4 ,,	41·6 ,,	49·0 ,,	65·4 ,,

A 5 per cent. nickel steel is used with success by one of our large rifle makers. Its ductility combined with great tenacity undoubtedly gives advantages, but there is still room for advancement. For instance, the special steel alloy of Messrs. Jessop is an improvement as regards ductility. A steel of this nature, with over 20 per cent. elongation and elastic limit and ultimate tenacity near 40 tons and 60 tons respectively, gives gunmakers a much superior metal to that in general use. For instance, such a steel would raise the

allowable pressures in our ·303 example from 17¾ tons to 23¾ tons. There can be no doubt that many other considerations have to be weighed besides the results from the testing machine, and these include the facility of working and the wear when metal-covered bullets are used. There appears, however, to be a tendency to leave the subject alone both by steel makers and gunmakers. If steel in the form of wire can be made with an ultimate tenacity of 150 tons, there must always be possibilities for improvement in rifle steel while its ultimate tenacity remains near 50 tons. The gunmaker has hitherto ignored the importance of considering barrel thickness having regard to powder pressures, and in the past he has not been materially assisted by the manufacturers of steel. Fortunately, both these drawbacks to progress can be removed, and in the near future we may see great improvements in rifle barrel steel.

A B.S.A. Air-Gun.—It must be a matter for wide-spread congratulation that the Birmingham Small Arms Co., Ltd. have for the first time in the history of the Company undertaken the manufacture of the proprietary firearm outside the ordinary scope of their military work. With Mr. Lincoln Jeffries rests the credit of having convinced them at Small Heath that air-guns are practical weapons and merit the aids incidental to first-class manufacture. This well-known gunmaker's improvements in the ordinary design of the air rifle have made the B.S.A. weapon a singularly perfect aim. The breakdown action has been abolished in favour of a solidly fixed barrel, the cocking of the spring being effected by a supplementary lever. It is understood that the B.S.A. Company have made arrangements by which they retain a free hand for the sale of these weapons throughout the trade, Mr. Jeffries of course receiving the suitable *quid pro quo* for the meritorious improvements which are associated with his name.

Arms Exhibit at Liége.—The collective exhibit of the Liége armourers, occupying a surface of 1,650 sq. metres (1,970 sq. yards), with the contribution of the Proof House, the Arms Museum, and the Ecole d' Armurerie, was officially inaugurated, on July 8, by the Belgian minister of industry and work, who warmly congratulated the armourers on their magnificent display. M. Maurice Braconier, president of the section, observed that the workmen, who have succeeded in maintaining Liége in the first rank of arms production in the whole world, make, with equal success, the simplest and the most complicated of weapons, while the *arme de luxe*, quite a work of art, is just as easy to them as one for export.

New Austrian Field-piece.—This gun, of 76·5 mm., 3 inch bore, and 30 calibres long, weighing 336 kg. (742 lbs.), is fitted with the flat wedge closing arrangement, which is reported to be simple and easily dismounted. The carriage is low down on the wheels, the distance between which is 1·6 metre (5ft. 3in.). It is provided with two movable shields of chrome steel 3 mm. (⅛ inch) thick, that will resist shrapnel balls, and infantry bullets, fired from a distance of more than 100 metres (109 yards). The weight with carriage and shields is 950 kg. (2,100 lbs.), or with loaded fore-carriage 1,750 kg. (1¾ ton). This cannon, made of forged gun metal, which discharges either shell or solid shot, can fire 21 rounds per minute.

EXPLOSIVES IN VICTORIA.

MR. C. NAPIER HAKE has issued his report for last year as chief inspector of explosives for the colony of Victoria. The following abstracts therefrom will doubtless be found of interest :—

The following explosives have been authorized for importation, storage and train transport, viz :—Smokeless diamond powder, Haylite No. 1, and the composition of Rack-a-Rock has been amended. The Government magazines at Bright and Castlemaine were closed during the year as they were little availed of by the public. Both these magazines have since been leased to private firms, and licensed as private magazines.

Importation.—One hundred and forty licences to import explosives were issued during the year. The nature, quantities and values of the explosives imported in 1904 are given in the following table. The importation (other than detonators) exceeded that of 1903 by 273,603 lbs. :—

Name of Explosive.	No. of Cases.	Weight in Pounds.	Estimated Value.
			£ s. d.
Gelignite	21,766	1,088,300	48,973 10 0
Gelatine Dynamite	4,471	223,550	11,736 17 6
Blasting Gelatine	2,256	112,800	6,768 0 0
Cheddite	1,200	60,000	1,650 0 0
Powder, Fuse ..	..	92,525	1,831 19 11
Powder, Blasting	..	176,625	3,002 12 6
Powder, Sporting	..	32,950	3,435 16 9
	..	1,786,750	£77,398 16 8
		Total Number.	
Detonators ..	957	4,649,000	£6,973 10 0

Blasting Gelatine.—The blasting gelatine imported during the year from European ports was of a very satisfactory nature ; only one consignment of 5,000 lbs. was condemned on account of exudation of nitroglycerine. This consignment was subsequently shipped by the local agents to Sydney.

Cheddite.—The whole of the cheddite imported during the year (two consignments) complied with the composition as defined by order in Council.

Gelatine Dynamite.—The gelatine dynamite import during the year was on the whole satisfactory, only two consignments (5,000 and 500 lbs.) being condemned on account of exudation of nitroglycerine. These were eventually used up by the ports and harbour departments in submarine work at Port Phillip Heads.

Gelignite.—The condition of the gelignite imported during the year was very satisfactory ; only two consignments (150 lbs. and 1,000 lbs.) were condemned on account of exudation of nitroglycerine. The smaller consignment was destroyed by burning, and the other was used up in connection with submarine work at Port Phillip Heads.

Safety Fuse.—The whole of the safety fuse imported complied with the requirements of the Act.

Manufacture.—The total number of factories under licence is seven. The system of licensing factories (similar to that initiated in Great Britain) ensures a thorough investigation of all technical details when the draft licence is under consider-

ation, and affords protection to the local interests concerned. Thirty rack-a-rock manufacturing licences were issued during the year.

Storage.—The total number of magazines under licence is 235, as against 220 in the previous year. There are fifteen Government magazines available for public use, chiefly for the storage of commercial explosives. On most of the private magazine sites, and on some of the Government magazine sites, annexes have been erected for the storage of detonators. This has proved to be a great convenience to the trade. In connection with the sewerage works being carried out in the suburbs of Melbourne, 21 magazine licences for the storage of explosives were issued. Owing to the near proximity of these magazines to public roads and dwelling houses, which is unavoidable, the quantities allowed to be stored were reduced to a minimum consistent with the carrying on of this important public work. Special precautions have been taken against accidents in the construction of the magazines by the issue of special rules, and by a condition in the licence which requires a keeper to be in charge of a magazine, both by day and night, and by frequent inspection.

Licensed Premises.—The number of licences issued during the year was 2,015, as against 1,923 issued during 1903. Apart from the official inspections, a number of premises in isolated places and small towns were visited by the police, under special instructions from me. Notwithstanding the thorough supervision, only twenty persons were proceeded against for breaches of the Act. This result, taken together with the generally improved condition of licensed premises, is satisfactory evidence that storekeepers more generally realize the importance of making themselves acquainted with their obligations, and of fulfilling them.

Accidents.—No accidents by fire or explosion occurred during the year, in the manufacture, storage, or transport of explosives.

TRADE MARKS.

REGISTERED. SEPTEMBER 6—27, 1905.

274,615. The word NEGADYNE. To apply to explosive substances. The Commercial Investment Corporation, Ld., London. July 26, 1905.

REGISTERED. AUGUST 23—SEPTEMBER 20, 1905.

273,778 } Cogswell & Harrison, Ld.
273,779 }

273,795 } Holland & Holland, Ld.
273,796 }

APPLICATIONS FOR PATENTS.

AUGUST 21—SEPTEMBER 16, 1905.

16,892.* Semi-Automatic Guns. W. H. Bevans.
16,894.* Gun Sights. F. A. Schanz. (Date of application in Germany, September 13, 1904).
16,899. Floating Mines. R. A. Palmgren.
16,924. Ordnance Sights G. Forbes.
16,946. Cartridge Transport. W. P. Wise. (Agent for *W. Lindsey*).
16,948. Target Carriage. H. E. Read.
17,089. Testing Sights. Sir W. G. Armstrong, Whitworth & Co., Ld., and J. Honner.
17,099. Telemeters. H. Gérard.
17,135. Targets. J. B. Ralston.
17,316. Automatic Firearms H. Stamm.
17,488. Aiming Firearms. W. Hommel.
17,710.* Projectile Fuses. Rheinische Metallwaaren und Mf. (Date of application in Germany, February 13, 1905).
17,711.* Time Fuse Setting Rheinische Metallwaaren und Mf. (Date of application in Germany, December 21, 1904.
17,740.* Mine Exploding. F. Schneider. (Date of application in Germany, October 25, 1904).
17,741.* An Explosive. F. Schneider. (Date of application in Germany, October 27, 1904).
17,795. Projectile Fuses King's Norton Metal Co., Ld., T. R. Bayliss and H. M. Smith.
17,799. Gun Fittings. Vickers, Sons, & Maxim, Ld., and H. B. Weeks.
17,805.* Report Silencer Aktieselskabet Nygaards Gevaerkompagni. (Date of application in Norway, September 3, 1904).
17,825. Cartridge Carrier. J. McArthur and W. Prain.
17,858.* Ordnance Sights. Fried Krupp, Ag. (Date of application in Germany, November 26, 1904).
18,034. Ordnance. H. P. Okie.
18,185. Projectile Fuses. King's Norton Metal Co., Ld., T. R. Bayliss, H. M. Smith and H. W. Brownsdon.
18,207. Ordnance Recoil Springs. F. T. Fisher and W. J. Griffiths.
18,275.* Safety Explosives. F. Volpert. (Date of application in Germany, September 10, 1904).
18,378. Torpedo Steering. C. Tuckfield and W. G. de F. Garland.
18,439.* Recoil Absorbing. B. Behr.
18,692. Explosive. O. Silberrad.

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

AUGUST 31—SEPTEMBER 21, 1905.

COMPILED BY HENRY TARRANT.

16,000 (1904). **Safety Fuse for Projectiles.** Col. H. C. Seddon, West Kensington. A cup-shaped piece of metal, called the "pressure cup," is so arranged in the base of a percussion fuse as to prevent any movement of the firing pin. In the base plate are bored holes through which the gases of combustion enter, and flatten out this pressure cup when the gun is fired. The firing pin is freed in this manner, but not until the projectile has absolutely left the bore. Accepted August 19, 1905.

17,827 (1904). **Ammunition Hoisting to Turret Guns.** Lieut. A. T. Dawson, London, and J. T. Horne, Barrow-in-Furness. The lower hoisting cage of apparatus designed to supply projectiles and powder charges to turret gun mountings consists of two parts which are loaded at different levels, but which are hoisted together by one hydraulic press. The load is transferred from the lower to the upper cage by rammers. The upper cage is also composed of two parts in order further to convenience loading and discharging. Accepted August 16, 1905.

19,148 (1904). **Ordnance Firing Mechanism.** Lieut. A. T. Dawson and G. T. Buckham, London. The striker of the firing mechanism of ordnance is so connected with the trigger that it may be mechanically released for firing in a manner similar to that usual when electricity is employed. A rod is pulled in one direction by the movement of the recoiling gun, and is caused to wind a spring drum. The reaction of the spring drum when the trigger is pulled carries the rod in the opposite direction, and brings about the release of the striker. Accepted August 31, 1905.

17,880* (1904). **Explosives Containing Nitrate of Soda.** H. Boyd, London.

18,269* (1904). **Manufacture of Cordite.** L. Le Brocquy, Dublin.

20,540 (1904). **Gun Position Indicating.** W. D. Kilroy, and Eversheds & Vignoles, Ltd., Chiswick, W. To prevent accidents, which might be caused by training the gun in one turret across a gun in another, an automatic electrical signal is arranged in each turret to indicate to the layers the

moment when their gun is in such a position, that it could not be discharged without injury to the gun or men in the adjacent turret. Accepted August 31, 1905

22,899 (1904). **Ammunition Hoists**. Sir W. G. Armstrong, Whitworth & Co., Ltd., and Sir A. Noble, Newcastle-on-Tyne. Improvements in the type of ammunition hoist described in Patent No. 16,373, 1903, consisting in working the ammunition clips, not as before, by cams, but by the weight of the shot itself. The weight of the article hoisted pushes forward the clips and continues to do so until they bear hard against the article. The diameter of the article may thus vary within certain limits. Accepted August 31, 1905.

22,986 (1904). **Safety Fuse for Projectiles**. Colonel H. C. Seddon, West Kensington. In Patent No. 16,000, 1904 (dealt with above), the patentee has set out a "pressure cup" safety device for fuses. This pressure cup is, according to the present patent, arranged at the side of the fuse instead of at the base. The firing pin is released when the pressure cup has been flattened out by the gas compression, by centrifugal force, which removes the locking piece. Accepted August 31, 1905.

22,337* (1904). **Back Sight for Rifles**. H. L. Bock, Canada.

23,113 (1904). **Machine Gun Attachment**. L. W. de Grave, Derby. A method of arranging for the complete action of machine gun mechanism when blank cartridge only is used, consisting in attaching to the barrel muzzle a relief valve, which is adapted to compensate the inequalities in the strength and amount of explosive. Accepted August 31, 1905.

27,706 (1904). **Nitroglycerine Manufacture**. A. Mizolajczak, Germany. A process of manufacturing nitroglycerine, invented to promote the production of dinitroglycerine in as large a proportion as possible. The percentage of dinitroglycerine is controlled by suitably proportioning the nitrifying mixture, the percentage of dinitroglycerine being higher with the decrease of the quantity of sulphuric acid compared with nitic acid used. The oil is eliminated from the acid liquids by adding an alkali such as carbonate of lime. Accepted August 10, 1905.

1,389 (1905). **Sights for Small-Arms**. E. H. Parsons & L. B. Taylor, Bournbrook, near Birmingham. The lift-up sight of the type described in Patents Nos. 2,735, 1900, and 13,345, 1901, is modified in order to facilitate the adjustment of the windgauge V-carrying slide, which is arranged on the free end of the hinged sight bar. By pressing a pin the slide is freed, so that it may be shifted by hand roughly to the desired position very quickly. The release of the pin re-engages two screw threads, and any further fine adjustment is made through these. Accepted August 17, 1905.

1,505 (1905). **Small-Arm Breech Mechanism**. E. Sanner, France. The breech mechanism of a gun with fixed barrels is arranged at the rear of the cartridge chambers in a circular space. The breech block is operated within this transverse cylindrical cavity by a lever lying below the trigger guard. The sear and hammers are enclosed within the breech box, and are re-locked by the rotary movement. Accepted August 17, 1905.

5,131 (1905.) **Automatic Small-Arm Mechanism**. K. G. von Pocci, Germany. By means of a spring lever suspended on the magazine front, the barrel of an automatic small-arm is held in the rearward position which it takes up after the recoil until the breech-bolt returns, and is again locked in position. A locking safety device which prevents the hammer reaching the striker when not desirable, is also described. Accepted August 31, 1905.

8,746 (1905). **Chlorated Explosives** L. Thomas, Paris. The manufacture of potassium or other chlorate or perchlorate explosives is modified so as to overcome their extreme sensitiveness. The chlorate of potassium is incorporated with solid dinitrotoluene which has been previously melted with or without the addition of nitrocellulose. Accepted August 10, 1905.

11,436 (1905). **Automatic Falling Target**. T. A. Hearson, London. (Agent for *Elektrotechnische Gesellschaft, m. b. H., Germany.*) A man-shaped target is arranged between two supports and is inflated with air or fluid. The air pressure holds the front support in position. When the target is struck by a bullet the pressure is eliminated, and the support falls forward. The target is in this way released and drops also. Accepted August 10, 1905.

12,539 (1905). **Portable Miniature Targets**. Maj. F. J. Choles, Natal. A portable miniature target, consisting of a series of targets proper mounted upon a stretch of canvas. The canvas is adapted to be rolled upon bars rotatably mounted behind two upright iron standards. The standards are driven into the ground, and support the canvas and targets in the proper position. Accepted August 17, 1905.

13,340* (1905). **Priming Compositions**. C. Claessen, Germany.

14,772 (1905). **Bullet Structure**. Floretta M. Aspinwall, U.S.A. In order to prevent the gases of combustion passing between the bullet and the bore of the rifle, the patentee extends the nickel envelope of covered bullets slightly rearwards. A cup is formed in this way. The gases expand it, and so automatically provide a gas check. Accepted August 24, 1905.

15,643 (1905). **Gas Check for Ordnance**. Fried Krupp, Ag., Germany. A plastic gas check for ordnance is designed to obviate certain disadvantages attaching to the ordinary gas check. The plastic material is surrounded by two protecting rings, and within the plastic cushion itself is arranged a "filling piece" (of steel) capable of withstanding pressure. Even after protracted use, it is said, this gas check does not cause jamming, due to the expansion of the protecting rings. Accepted August 17, 1905.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

PRIMING COMPOSITION.

13,340 (1905). C. Claessen, Germany. Progress has been made recently in the initial priming industry by the substitution for part of the fulminate of mercury in detonating caps of picric acid or trinitrotoluol. It has been discovered that with a cap containing 0·7 to 0·8 grammes of picric acid upon which an initial cap containing 0·4 grammes fulminate of mercury is placed, an effect is obtained practically equivalent to that of a cap containing 2 grammes of fulminate of mercury. Parallel with the magnitude of this effect is also the capacity for the ignition of explosives, especially those of the ammonia saltpetre type.

The patentee has made a further discovery, inasmuch as that he has found that far greater proportioned effect is obtained if in place of the picrid acid or of trinitrotoluol, tetranitromethylanilin or tetranitroethylanilin is employed for filling caps. The penetrative effect of these substances may of course be modified by mixing them with the usual additions, especially with oxygen carriers.

The advantages of tetranitromethylanilin have been fully demonstrated, as compared with picric acid when employed in explosive caps, by its employment as shell or torpedo charges. When tested in the usual way in the lead block 10 grammes of tetranitromethylanilin have given expansion of 480 ccm. as compared with 360 ccm. with picric acid, and 370 ccm. with trinitrotoluol. Another advantage is the absolutely indifferent behaviour of this compound towards metals even when moist. Accepted August 13, 1905.

MANUFACTURE OF CORDITE.

18,269 (1904). L. Le Brocguy, Dublin. The patentee explains that cordite as at present manufactured is subject to deterioration by exposure either to light or heat, or by mere storage for any length of time. This instability of cordite and the ultimate production of smoke when fired is caused by the "semicrude mineral jelly" usually employed in its manufacture becoming itself partially nitrated in the course of time. This is due to the olefines and napthenes in the jelly which possess great affinity for nitrous acids, gradually absorbing the latter with a speed governed by the temperature or the time or amount of light they are exposed to. The new nitrocompounds so produced diminish the explosive power and cause a yellow smoke to generate when the powder is fired.

To obviate these defects and so render the cordite stable the semicrude mineral jelly is substituted by a pure hydrocarbon oil or jelly as free as possible from olefines and napthenes. Paraffin wax or ceresine or both may or may not be added. A natural but purified

mineral jelly, such as white mineral jelly, is suitable for the purpose as it is free from unsaturated hydrocarbons, and the affinity for absorption of nitrous acids is reduced to a very low point. Paraffinum liquidum or other refined synthetical or natural mineral jelly or oil or a mixture of a synthetical and a natural product refined to whiteness may be employed. The purified jelly may have a minimum flash point of 400 deg. F. and a minimum melting point of 86 deg. F., but these points may be varied to suit different requirements. Accepted August 17, 1905.

EXPLOSIVES CONTAINING NITRATE OF SODA.

17,880 (1904). H. Boyd, London. The difficulty which has been experienced with explosive compositions containing nitrate of soda as the oxygen-bearing body arises from the fact that they are extremely hygroscopic. This disadvantage the patentee desires to obviate. The object is accomplished by treating the nitrate of soda with suitable substances which shall have the effect of rendering the granules damp resisting; and instead of having any adverse effect upon the action of the explosive shall enhance the volume of the gases of combustion.

With the nitrate of soda is first mixed approximately equal proportions of powdered resin and powdered or finely divided napthalene, the proportion of resin and napthalene relatively to the nitrate being about one third. These substances are thoroughly mixed together in an incorporating mill for about half-an-hour, and during the mixing they are sprayed with petroleum or other hydrocarbon which shall have the physical effect of causing the mixture to assume a stiff paste or semiplastic condition. The mixture is removed from the mill and powdered petroleum shale equal to about one half the bulk of the nitrate together with about one third the bulk of powdered sulphur are added. The consequent compound is remilled and afterwards is added any suitable modifying agent to prepare the explosive for the work it is intended it shall do. The compound is granulated and pressed into cartridges. An ordinary fuse will fire it. Following is an example of the proportion in which the ingredients may be mixed :—nitrate of soda, 35 per cent. ; resin, 10 per cent. ; napthalene, 10 per cent. ; petroleum shale, 15 per cent. ; sulphur, 10 per cent. ; and other ingredients, 20 per cent. Accepted August 17, 1905.

BACK SIGHT FOR RIFLES.

22,337 (1904). H. L. Bock, Canada. A back sight of the hinged bar type is described in this specification. The height of the laterally moveable V-carrying part which is attached to the free end of the bar is regulated by a slide adapted to move along the horizontal bed of the sight. Rough adjustments of elevation to one hundred yards are imparted to the sight by this slide ; and finer adjustments are given to the sight by a micrometer screw arrangement which moves the slide and the bed upon which it works endwise in a direction parallel with the axis of the barrel.

The sight is fully illustrated by the drawings reproduced on this page. The sight base *a*, through which the sight is attached to the barrel, carries the swinging leaf *b* hinged at *c* to a pair of lugs. The free end of the leaf is bent over upon itself so as to form a collar which is internally screw threaded and is adapted to accommodate the screw bar *d*. The sighting piece proper *e* which carries the V-notch (Fig. 4) is supported by the head *f* and the milled nut *g* at the other end of the screw *d*. When the milled head is turned by the fingers the screw *d* works through the turned-over end of the leaf *b*, and so takes the sighting piece *e* either to one side or the other of the leaf. The exact disposition of these parts is shown in the small detailed drawings.

The leaf *b* is composed of sheet metal. Its sides are bent to form the ribs *h* and *i* (Fig. 5), and these ribs are engaged (*h* on its upper side, and *i* on its under side), by the pins *j* and *k* respectively. The pins *h* and *i* are carried by lugs upstanding from the elevator slide *l*. The contour of the ribs is arranged in a compensatory curve so that the movement for each 100 yards elevation imparted to the sighting piece *e* shall be obtained by an equidistant horizontal displacement of the slide *l*. The pins *j* and *k* are arranged so that each exerts a little pressure upon their corresponding ribs. The leaf is in this way subjected to a slight torsional strain which enables the elasticity of the metal to be utilized in keeping the device free from any looseness in the articulated ioints without interfering to any appreciable extent with their freedom of movement.

The elevator slide *l* is fitted to slide on the base *a*, and is kept from rising by the two index slides *n* and *o* (Fig. 3). The slide is provided with two lock bolts which have the heads *r* and *s* and two

Fig. 1

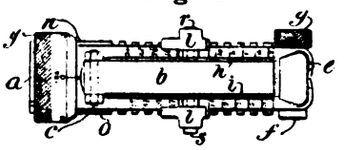


Fig. 4

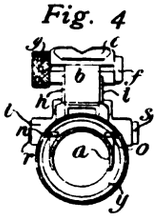


Fig. 5

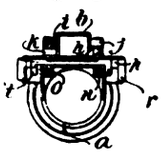


Fig. 2

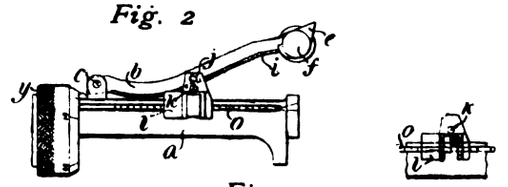
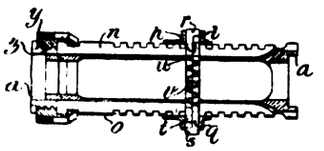


Fig. 3



downwardly projecting teeth *t* and *u* respectively. The lock bolts work in a slot in the slide *l* and are pressed in opposite directions by the spring *v*. The teeth *t* and *u* are thus drawn against the rows of notches formed in the sides of the index slides *n* and *o*. The notches are opposite each other, so that when one tooth *t* engages a notch the other tooth *u* abuts against the land between the notches. When the bolts are pressed inwards by the fingers the slide *l* is free to be shifted along the index slides *n* and *o* and to elevate or depress the sighting piece *e*.

The notches are so placed that when one bolt is moved from a notch to the adjacent land the slide is caused to elevate or depress the sighting piece to an extent suitable for a change of 100 yards in the range. In order to provide for a finer adjustment of the sighting piece to accord with ranges between each 100 yards the index slides are adapted to be shifted endwise by the micrometer thimble *p*. The pitch of the screw thread *q* on the base *a* is such that one complete turn of the micrometer screw shifts the index slides, and thus the elevator slide *l*, endwise a distance equal to that through which the elevator slide moves when altering the elevation for a modification of 100 yards in range. The thimble *p* is provided with circumferential graduations so that any desired fraction of rotation of the collar may be indicated. Accepted August 17, 1905.

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CONTENTS.

CURRENT TOPICS.

Proof House Prosecutions.—The fact that the Gunmakers' Company has apparently awakened from a period of quiescence, and has instituted proceedings against infringers of the Proof Act affords welcome evidence that the proof authorities in London adequately appreciate the public importance of their functions. One cannot of course feel anything but sympathy for a firm of the standing of Messrs. Debenham, Storr & Sons when they are called up in a police court amongst criminal malefactors to answer an offence which is purely technical in character, and in no way reflects on their methods of business. It is, however, only by punishing every offence reported that gun dealers can be brought to realise the full extent of the responsibilities which rest on their shoulders. It is of course a curious aspect of these prosecutions that many offences are daily committed which are passed over in silence. If words have any meaning the gun which has not been nitro proved is itself an unproved gun. In a similar manner no prosecutions are instituted in reference to guns which have been so changed in calibre since the time of proof as to require re-proof before they can be legitimately re-sold. The dormant attitude which is adopted towards offences of this character may be attributed to the circumstance that no danger appears to arise from such causes. Those who have measured the chamber pressure exercised by various sporting charges must be well aware that a proof stress which is not destructive to the gun cannot exceed, except by a very small margin, the service pressure of a fully-charged cartridge. With abnormal loads the separation between proof and service is still further restricted; but it seems as though the quality of workmanship put into a gun is such that it can stand a large excess on the ordinary ballistics without involving actual danger to the shooter. We may accordingly regard the action of the proof authorities as conceived on the best lines, viz., strictness where public safety is involved, and generous toleration where no one is the worse therefor.

The 12-Bore Cartridge.—We are losing ground whenever we stand still is as true of the sporting cartridge as of other things. The past few years have witnessed many important developments in the arrangement of charges and the regulation of powders. The trend of events is towards the use of lighter charges. The ounce-and-a-sixteenth charge of to-day performs all the functions of the ounce-and-an-eighth charge of twenty years ago. This fact is recognised by the loader just as much as by the powder maker; by the former because he loads more charges than ever before on the lighter scale, and by the latter because he regulates the behaviour of his product pre-eminently with reference to the lighter charge. The idea has been mooted of late to recognise these facts by making a radical alteration in the cartridge case so that it shall be more suitable for modern conditions. The ⅞-in. wad has always been recognised as the standard thickness to be used in combination with the full charge of shot. When the shot is diminished to one ounce the half-inch wad must be used, and this represents a thickness of material which militates to some extent against the satisfactory action of the cartridge. To put such a change on a proper footing it would be advisable to increase the thickness of the paper lump in the base of the

cartridge so that a $\frac{3}{8}$-in. felt wad should be sufficient for the ounce-and-a-sixteenth charge of shot. The cartridge case would benefit from the extra stiffness of the head, the loader would experience a definite saving in the cost of a hundred cartridges, and the powder maker would benefit by an increase in the efficiency of small loads and reduced opportunities for overcharging cartridges. Matters have not developed sufficiently far to justify at the present stage more than this general reference to a decidedly ingenious idea.

The Price of Cartridges.—Gunmakers have naturally been somewhat perturbed by the unexpected launching forth of a joint notice of a rise in the price of cartridges and cartridge components. The inconvenience attaching to such a disturbance when the season's business is in full swing and all price lists have been issued cannot be exaggerated. Gunmakers have our sincerest sympathy for this new trouble which has been added to the carrying on of a business by no means free from difficulties. An explanation for the issue of the circular referred to is not difficult to find. Although the alleged cause is increasing cost of materials it must be recognised by all who give the matter a moment's consideration that this has come about more gradually than the urgency and suddenness of the circular seem to denote. The real trouble no doubt arises from the constant lowering of the grade of cartridge purchased by the consumer. Foreign competition some years ago made it necessary for our manufacturers to issue a competing cartridge which undoubtedly gave too much value for money. Sportsmen were not long in finding out the virtues of the cheap cartridge. Consequently although the number of rounds of ammunition yearly sold shows a steadily-increasing total the diminished price per round has more than counterbalanced the apparent gain. Accompanying this development the sportsman and the gunmaker combine in demanding from the cartridge maker a markedly higher standard of workmanship. Consequently while cost has diminished quality has been improved; and the result is that a big output of cartridges shows but a very small profit to the manufacturer. The ammunition business being but little influenced by foreign competition, and the representative manufacturers being few in number, there appears to have been no difficulty in arriving at a friendly agreement that the pinching of the shoe has reached bursting point. It now rests with the retailer to arrange a round-figure rise of price to leave a little larger margin than heretofore to cover the expenses of distribution. It is to be hoped that a remedy on these lines will shortly be found.

Our Lecture on Recoil.—This somewhat stereotyped heading may be justified in the present instance by the circumstance that our knowledge of recoil is daily advancing. If the information existing five years ago were compared with what we regard to-day as common knowledge it would indeed be admitted that our understanding of recoil has made remarkable strides. The common complaint against technical information to the effect that it frequently lacks practical application does not apply in the present instance. Recoil clearly controls the admissible weight of a gun or rifle, so that anything which enables us to measure the one supplies a means of fixing the value of the other, without the tedious process of accumulating practical experience. In the present lecture a somewhat novel application of recoil measurement has been brought into prominence. There are many cartridge loaders who would appreciate the opportunity of ascertaining the velocity of their ammunition, but who are deterred from so doing by the expenses and complications incidental to the employment of a chronograph. The ballistic pendulum long ago made us acquainted with the exceedingly close relation which existed between the pendulum movement of a suspended body and the momentum of the mass which sets it in motion. In the case of the shot gun the many confusing factors have made it difficult to gain a clear apprehension of the relation that exists between the velocity of the shot and the movement of the gun in recoil. The late Mr. Housman's ingenious application of a well-known principle gave us a proof gun for sporting cartridges which once and for all overcame the difficulties of registering the recoil. Our own mathematical analysis of the movement which takes place in the gun when a shot is fired has enabled us for the first time in the history of shot gun experiments to put forward a simple formula for converting recoil movement directly into 20-yards velocity of the cartridge. When this formula has been expanded into a suitable series of tables the owner of a pendulum proof gun may register the velocity of any cartridge provided he knows the weight of the powder and shot contained therein. Such an accomplishment appears worthy of the prominence devoted to it elsewhere in this issue.

Obituary.—Our feeling of regret on hearing of the death of Mr. W. G. Froome is to a certain extent tempered by the knowledge that life had been a burden to him for many years past. Mr. Froome was by natural temperament and physical development one of the heartiest men that it has been our pleasure to meet; but all these things count for nothing in the presence of serious nerve disturbance. That his health was permanently shattered was known to us for many years, and always with a consciousness that he was thus cheated out of enjoying the fruits of a singularly successful career devoted to the regulation and adjustment of sporting rifles. What Mr. Purdey is amongst gunmakers, so Mr. Froome was amongst the shooting men who plate and adjust rifles during the processes of manufacture. To this day Mr. Froome's marvellous control over the nerves which later on played him so scurvy a trick, was a byword amongst gunmakers. He stood up to the heaviest rifle like a rock, and when the shot on the target came to be examined it was found to have been directed with a degree of precision seemingly unaffected by the punishing blow of the recoil. Mr. Froome had many friends and many admirers, and his memory will certainly be cherished as that of one who, in carrying out his daily work, did much to maintain the reputation of English gunmaking. Very nearly the same words of praise can be accorded in a different degree to the career of Mr. Thomas Southgate who fell a victim last month to a complaint which left no hope of recovery. Mr. Southgate, spectacles on nose, and file in hand, did much in a remote quarter of Bloomsbury to sustain the reputation of the many gunmakers for whom he worked. His speciality was the manufacture of actions for best guns, and the quality of his work only found an equal in the corresponding degree of skill which Mr. Squires imparted to the making of the barrels. Although these two workers were widely separated as regards distance it can safely be stated that they were as brothers in business their joint workmanship finding its way into many guns.

THE MAKING OF SHOT GUNS.

THE bread and butter business of the English gunmaker must always be chiefly concerned with the manufacture of the ordinary double-barrel shot gun. The problem of manufacture must necessarily take two forms according to whether the manufacturer carries on a wholesale or a retail business. The wholesale manufacturer is required to supply a large number of grades of gun having various individual peculiarities according to the market for which they are intended, and in many cases according to the particular dealer who has given the order. The problem which constantly faces him is to ascertain by what means he can meet the ever-present demand for better value at a lower cost of production. The retailer on the other hand is not so much influenced by competing prices as by the constant need to keep his name before the public, and gain for the weapons he sells a reputation for sound workmanship and efficiency. Most retailers manufacture, or what amounts to the same thing, supervise the manufacture, of their own special models. Any gaps in their range of goods can easily be filled by purchasing the requisite class of weapon in the best market. It is here in fact that the retailer exercises a very important influence on the problems which are always present in the manufacturer's eye. That is to say the manufacturer is ever divided between two methods of working his business. The first is to cultivate friendly relations with all his trade customers, so that each may range as a vendor of weapons having an individuality of their own. The alternative plan is to endeavour to systematise the various grades in daily demand and so cut down to the smallest possible extent the number of models turned out. Such a course of action diminishes the dead stock charges for tools, components and partly finished goods. At a time when competition was less severe the first policy paid very well. The large retailer made a substantial dealer's profit, and the manufacturer in the background showed satisfactory results on prices he himself received. With the closing of the American market, and an increasing amount of manufacture by firms who were formerly satisfied to buy everything they sold, the maker on a large scale has found it necessary to cast around for means of employing his plant and staff. It necessarily follows that many possibilities of business, which were formerly disregarded as hardly worthy of attention, have since assumed a different aspect. The cheaper classes of gun which were put together by the garret workers produced but a meagre livelihood for the workmen engaged on them. The trader's profit was again small by reason of the fact that such goods are too often a cut line. Finally as regards the consumer, these weapons commonly gave but little satisfaction, generally because of defects in workmanship arising in the main part from pure carelessness. Extra cost would in fact hardly be involved in getting rid of the more palpable evidences of indifferent workmanship.

It is here that the manufacturer may find valuable opportunities for developing a fairly profitable department of business. If a certain type of gun can be manufactured at a certain price by sub-dividing its output amongst a number of out-workers, the same gun should be capable of being turned out in a superior fashion and at a lower price if a skilful manufacturer lends his co-operation to the scheme. Certain operations previously performed by hand with an indifferent degree of workmanship can be machined by power at a lower cost and on a superior scale of efficiency. In like manner the actual operations which are still most economically performed by hand can be better carried out if the manufacturer in his subsequent viewing pays due regard to the causes which produce inferior results. The use of obsolete and worn tools may, for instance, be remedied by the supply of better appliances. More than this, each man who performs a given operation may acquire additional practice and skill by constant repetition of the same, instead of passing from one job to another. Such men are prone to develop the characteristics of a jack-of-all-trades, in that they are master of none. It rests with the manufacturer to endeavour to correct this tendency by minimising the number of models of any particular class of goods which he is prepared to sell. Every double-barrel gun in existence seems to perform much the same set of functions when once it reaches the user's hands. It is hammer or hammerless, it is an ejector or a non-ejector, and the barrels are cylinder or choke as the case may be; but it does not seem to matter one single iota what kind of third grip the breech mechanism carries, nor the particular method by which the fore-end is fastened. Nevertheless we find from manufacturers' catalogues that they draw an immense number of distinctions in detail which cannot appeal to the user. To our way of thinking, guns need only to be classified by the one simple condition of price. The £3 hammer gun should do everything which a gun can do for that amount. The manufacturer should decide the class of lock and breech fastening to be fitted. In a similar fashion the £5 gun should contain as nearly as possible the same characteristic principles of manufacture as its cheaper prototype, the difference in cost being represented by sundry improvements of adjustment and regulation which disturb as little as possible the foundation work put into the stock, action, and barrel. The £7 hammer gun should again represent the manufacturer's own selection of what is the all-round best that can be supplied for the sum of money specified.

There is no reason why the manufacturer should do more to discourage orders for odd types of construction than by leaving them to be turned out under existing arrangements. The retail dealer would need to allow a greater margin of time for the execution of his order, and he would necessarily find that such guns formed a greater source of anxiety in his business than the specialised models of which each part has been subjected to special study and manipulation. The specialised models would always represent better value for money, and retailers are so separated by distance that each would secure for himself the reputation for supplying good sound guns at a low cost. The competition which menaces the manufacturer in one way is equally severe on the retailer from another point of view. Firms who originally entered business as purveyors of athletic sweaters and sixpenny-halfpenny ties are now full-blown gun dealers. They have little or no knowledge of guns, and trust merely to sound business methods to create a demand amongst the public. They accordingly demand from the manufacturer a sound workable article representing the best available value for money. The manufacturer is bound to satisfy this demand, and the ordinary retailer must adopt the same class of goods to obtain equal value for money.

THE INSTALLATION OF RIFLE RANGES.

A SOMEWHAT regrettable aspect of recent rifle club developments is that the range must be equipped before the members have had the right kind of experience. As a result the money is spent, and the equipment, good, bad or indifferent, must thereafter be utilised to the best possible advantage. Printed matter on the subject, although accumulating rapidly, does not seem to be effective in the prevention of mistakes. It is accordingly proposed in the present article to review some of the points which seem worthy of attention in the light of a fairly wide experience of range equipment as it now exists.

In the first place the lighting requirements are very ill-defined. There must be a best system of illumination; and it seems reasonable to suppose that the conditions present in an outdoor range come closest to the ideal. The problem of illumination is concerned not only with the number of lamps used and their position with relation to the target, but it is seriously influenced by every fixture and fitting which is liable to throw a shadow in the region of the target. So diverse are the opinions held by shooters that there is not even at this moment any concensus of view as to whether the area surrounding the card target should be black or white. In most clubs everything but the target is painted black, or is allowed to assume a dark neutral tint tending towards soot in colour by the natural action of a smoky atmosphere. A possible explanation for the prevailing wish for black is the impression that the target is thereby thrown into greater relief. In our opinion dark surroundings to a target can only be justified by the presence of so many deep shadows as to make total blackness preferable to a medley of ill-assorted patches of light and shade. Confining attention for the moment to indoor ranges, bad illumination can generally be traced to the foundation circumstance that the card target is more often supported from beneath than from the top. To gain a proper view of the sights it is desirable that the greatest possible area of white should show beneath the bull. Yet very often as much as a third of the white target is hidden from view by the groove in which it rests, and by the black shadow which is thrown on the card by the strip of iron which protects the fastening gear. As all clips and supports must be protected from the bullets, it stands to reason that the iron used must ultimately attain a black colour. It, therefore, seems obvious that the proper method of supporting card targets would be to place supporting beams above the level of the targets, the same to carry at the back a series of spring clips capable of suspending the targets from the top.

The footlights, occupying as they do a position near the ground, would then impart the best possible illumination to the card, itself free of all shadows. The very fact that the lights are disposed at a level lower than the target would imply the absence of any shadows behind the target as viewed from the firing point. In the top suspension of the card we thus have one of the first conditions for producing a well-illuminated target and background. By whitewashing the floor, and if space permits of a sloping heap of well-sifted sand reaching as high as the bullets are likely to strike, a suitable means is provided for maintaining a neutral tinted background sufficiently illuminated to show the target against a natural background. No matter how beautifully an iron stop-plate may be painted white in the first instance, it is almost certain that sooner or later it will show signs of wear, especially on the parts where the bullets strike. The well-heaped bank of sand has many advantages, such as the prevention of back splashes from the bullets, and the diminution of wear on the iron plates. Amongst other advantages may be mentioned the greater visibility of shot holes in the bull when viewed through a telescope. The smallest glint of light through a hole in the bull suffices to show where a shot has struck, and this information is of great value to the conscientious marksman.

In dealing with target apparatus various points of view should be taken into account. It is the ambition of most clubs to possess an arrangement of winding tackle to carry the targets backwards and forwards between the firing line and the butts. The mechanical difficulties of making a satisfactory installation of this kind are at present well-nigh insuperable. For instance, we recently visited a club in which literally hundreds of pounds had been spent in an installation of pulleys, cables and trolleys for operating the targets. Those which were still in working order afforded great delight to the officials of the club for showing visitors how well things were managed; but, curiously enough, when actual shooting commenced it was found that the trolley arrangement was never used, and that the official in-charge went to the butts to renew the used targets.

A very serious disadvantage of the trolley system of changing targets consists in the fact that there is no obvious means of bringing the targets to the firing point without seriously curtailing the space available for the accommodation of the shooters. The trolley and rails system which received the award of the Bisley Committee in 1904 possesses this disadvantage to a very marked extent, the trolley taking up the same width at the firing point as an ordinary shooter. More than this, a trolley for each target limits the shooter to a narrow space with walls parallel with the length of the range, whereas correct form in shooting requires that the marksman shall lie with his body at an angle of about 45 deg. The Ian-Hamilton system of target, as recommended and used by the Society of Miniature Rifle Clubs, is undoubtedly the best model of indoor miniature target in use. It takes away virtually no space from the area of the firing point. Several targets can be renewed by one winding operation, and the gear is so light that no great effort is involved. Finally, and most important of all, the one set of apparatus is equally adaptable for stationary target practice and moving and disappearing competitions. A simplification of this gear, by which the various pulleys could be fixed to brackets or beams attached to the building, would probably supply the best form of target renewal apparatus where reasons exist to prevent working them by hand. We will dismiss this aspect of the question of range fitting and accommodation by expressing the opinion that, however wealthy a club may be, the cash expended at the start on target apparatus should be cut down to a minimum.

A wooden erection standing about 9 ins. above the floor level should traverse the whole width of the range at a distance some 6 ft. back from the wall. This should be faced with an iron plate, and behind the cover so provided should lie a line of gas piping carrying incandescent lamps at intervals of about 2 ft. A similar distance beyond the iron plate should be another timber framework also 9 ins. high.

As many loads of sand as are necessary to make a sloping bank from the top of this line of wood to the wall behind should then be introduced. The target suspension apparatus might consist of a plain three-by-four plank, faced on the side towards the shooting point with a strip of iron. This bar should stand with its lower edge about 20 ins. from the ground, and it should be set back from the footlights at a sufficient distance to secure a suitable amount of illumination on the targets suspended from it. Ordinary ingenuity would be capable of devising means for attaching behind this bar paper clips or other similar contrivances for holding the card targets. Here we have an equipment which would give better shooting accommodation than is available at 90 per cent. of the clubs we have hitherto visited. Such refinements as disappearing and moving targets might easily be provided by a little additional mechanism when once the need for them has arisen.

Concerning the question of illumination at the firing point, it is very difficult to understand why so many clubs seem to prefer the abnormal conditions which are produced by a degree of darkness which makes it difficult to lay hands on one's cartridges. That considerations of cost do not supply the missing explanation may be assumed from the circumstance that many firing points which are properly illuminated in the first instance are afterwards screened from light at the wish of the members. It would surely seem as though the presence of a reasonable amount of illumination at the firing point is desirable, but this is a matter upon which it is dangerous to theorise. The very conditions of darkness which are so much desired would apparently open the iris of the eye to an extent interfering with the proper definition of the sights. Orthoptics may, of course, provide a remedy for this evil; but practical experience certainly shows that a darkened firing point is preferred, and a practical explanation of this point is needed. There may, for instance, be no middle course between a well-illuminated range properly lighted from end to end and one which is kept as dark as possible everywhere except on the target and its immediate surroundings. The shooter who faces a length of range of tunnel-like darkness may experience an expansion of the iris which renders the eye very sensitive to light from behind. If there is any truth underlying this supposition, it would appear that where considerations of cost render it impossible to illuminate the entire length of a range the lighting of the firing point should be conducted on lines that will provide a reasonable amount of well-diffused light, nowhere so strong as to cause inconvenience. An unscreened light in the background, preferably of large surface, would undoubtedly be serviceable in providing a source of illumination for inspecting the adjustment of the sights. By holding the rifle in a suitable position the surface carrying the elevation marks would catch the rays emanating from such a lamp, and so enable the shooter to make any required adjustment. What has been said on the subject of illuminating the firing point seems again to show that initial expenditure should be kept as low as possible, with a view to spending the available money when experience has defined the best course to pursue.

In regard to open-air ranges which are less concerned with restrictions of space, the above recommendations as to the arrangement of the butts apply with equal force. It is above all things necessary to throw the target as much in front of the bullet-stopping screens as possible.

A RABBIT LOAD.

SIR,—As a shooter I have been much interested in your recent editorials on special cartridge loads. I used a good many of the Litemode cartridges last season and liked them very much indeed for cover shooting. The reason I am writing, is your remark that a suitable rabbit cartridge has not yet been altogether evolved. I therefore gather you would welcome some correspondence on the subject from those who have tried to solve the problem. I have been using a rabbit load for the last eight years, which quite suits my gun and myself. Further than that of course I cannot go, tastes differ so much. It consists of 40 grains ordinary Schultze and 1 oz. No. 4 shot. It never seems to knock a rabbit about, however short the range, and the pellets are heavy enough to cut through any amount of undergrowth, and will moreover be numerous enough to account for the odd pheasant that may come unexpectedly to season the bag. Although I only speak of what I understand—its excellence in the field, I always shoot a few at the plate out of each batch I order. I give the result of the trial of my last 1,000 last season. I have known the patterns a little higher numerically, but actual use shewed they performed up to the average. I fire alternate barrels, my gun is a cylinder, both barrels giving a pattern of about 130 with standard charge of No. 6.

30 in. Circle at 30 yds.:—117, 139, 126, 129, 127, 130; do. at 40 yds.:—67, 79, 79, 76, 82, 76.

I dare say some of your readers may be able to evolve a powder charge more ballistically correct, but as an amateur I have to take my powder as I find it. I worked up to 40 grains and down to 40 grains, half a grain at a time, and for the powder as it stands there is nothing to beat 40 grains. But the powder charge may be capable of improvement. What I am convinced about is that for a perfect rabbit cartridge 1 oz. of No. 4 shot is the nearest you can get. It has a peculiar sort of deadliness and in my experience a rabbit struck with No. 4 always seems deader and less knocked about than when any other sized shot is used—even Mr. Lloyd Price's ¾ oz. No. 3. The Litemode contained 7-8ths oz. of No. 5 I know, but I suppose there would be but little noticeable difference in recoil or velocity, theoretically or in practice between 7-8ths of No. 5 and 1 oz. of No. 4. I only offer these opinions for what they are worth. They may or may not be of use, as in shooting the "personal equation" has to be allowed for to such an extent.

Yours faithfully,

WALTER H. BAXTER.

[Our Correspondent has undoubtedly hit off a very excellent and popular charge for a rabbit cartridge. It is not of course every gun that will do justice to 40 grains of a 42-grain powder working in combination with one ounce of shot; but when the gun is there it would be difficult to find a more satisfactory cartridge. The quality of deadliness referred to may be ascribed to the considerable striking power of a pellet of No. 4 size, the thinness of the pattern being compensated by the large area presented by a rabbit's body. Rabbit cartridges must vary in charge according to the conditions of sport. The farmer who creeps round his hedgerows and takes them sitting at 50 yds. needs as much shot as can be crammed into the case.—ED.]

CONTINENTAL DOINGS.

EXPLOSIVES AT THE LIÉGE EXHIBITION.—In the international section, comprising countries not represented officially, in Group 14, Class 87, the Union Espanola de Explosivos, representing the Santa Barbara Company at Oviedo, the Spanish dynamite company at Bilbao and the Bilbao Industrial and Commercial Company, shows models and photographs of these various works, together with their products and the materials entering into their composition.

KRUPP MOUNTAIN GUNS FOR JAPAN.—The general staff of the Japanese army is credited with the conviction, drawn from the experience of the late war, that light mountain guns are preferable to ordinary field pieces in a country without roads. The Krupp Company is expecting the visit of eighteen Japanese officers for taking over some artillery; and the manager will avail himself of the occasion to submit a battery of mountain guns.

AWARDS AT THE LIÉGE EXHIBITION.—The international jury of the Liége Exhibition, which is to close on 6th November, has awarded *grands prix* to the Liége Proof House, the School of Armoury, the Fabrique Nationale d'Armes de Guerre, the Fonderie Royale de Canons, the State Arms Manufactory, the Cockerill Company (for its cannons), the Krupp Company, the Société des Forges et Aciéries de la Marine, Saint-Chamond, the Deutsche Waffenfabrik, Carlsruhe (for its small arms) the military diorama and several Liége armourers. Lieut. Bremer has obtained a gold medal for his self-scoring target, described below.

KRUPP *versus* SAINT-CHAMOND FOR BELGIAN FIELD PIECES.—In 1903 the Brasschaet Polygon received several field pieces from various works, with a view to adopt a type for the Belgian army; and, as the result of stringent trials, preference was given to the Krupp and Saint-Chamond guns. On the proposition of the Commission, it was decided to order two batteries, one from each manufacturing company; and last winter these two batteries were tried as to firing and travelling, while they also took part in the annual manœuvres. It is now considered certain that the Krupp guns will be accepted, because certain faults have been found in the Saint-Chamond piece. Two establishments, however—the Fonderie de Canons and the Arsenal de Construction—have been invited to suggest means for remedying these defects.

NEW SELF-SCORING TARGET.—Lieut. Bremer, of the Belgian army, has invented a new electric self-scoring target, which gave good results at the International Rifle Competition, Brussels. It comprises three principal parts—(1) the target proper, divided into a great many annular segments; (2) the electric indicator, being a reproduction of the target on a small scale, placed near the marksman; and (3) electric conductors, connecting each annular segment with the corresponding segment of the indicator. The principle consists in utilising the blow of the shot for causing the bullseye and various segments, whose centre of gravity is always a little out of the vertical (being inclined towards the shooter), to pivot round a horizontal axis. This oscillation in the backward direction is utilised for closing or breaking an electric circuit, registering the shot, while the weight of the plate brings the parts back to the first position. The several rings forming the target overlap one another, so that the shot cannot pass between them. The rings are again divided into segments; and the striking of one of them by the bullet is immediately indicated on the scoring target, thus showing the annular segmental plate that has been struck. Moreover, the segments are made of such hard steel that the bullets striking them are pulverised, so that the danger of ricochet is avoided. A variety of the Bremer target, which received a gold medal at the Liége Exhibition, takes the form of a man, subdivided into parts that are reproduced in the scoring target.

TESTING SAFETY EXPLOSIVES.—In a paper presented to the Liége Mining Congress, Dr. J. Daniel observed that—first among the problems connected with the use of explosives in the presence of fire-damp and coal-dust is the experimental determination of the degree of security realised by what are called safety explosives. Testing stations for solving this problem were installed in various countries but very soon the results obtained with identical explosives, when tested at different stations, showed great contradiction. Testing explosives at a station combining all the different tests constitutes the only method of obtaining a rational means of comparison; and with uniform conditions of experimentation causes of error would be reduced to a minimum.

INTERNATIONAL TESTING STATION.—In accordance with the above conclusions Dr. Daniel proposes that an international Commission be appointed for framing a programme of tests, to determine with some approach to finality the degree of security attained by various explosives intended for blasting in underground workings containing fire-damp and coal-dust. With a view to carry this proposition into practical effect, the Belgian Government should be requested to allow the use of its testing station at Frameries. There, it may be remembered, the tests are carried out in the presence of actual mine gas, the most explosive in the whole world, obtained from the adjoining colliery of the Société Anonyme des Charbonnages Belges.

FRENCH CANNONS AT THE LIÉGE EXHIBITION.—The Saint-Chamond division of the Compagnie des Forges et Aciéries de la Marine shows a large and fine collection of French army and navy cannons, including the following:—A 24 cm. (9⅝ in.) coast mortar on carriage with central pivot, 13 calibres long, firing a projectile weighing 215 kilogrammes (475 lb.) at a muzzle velocity of 300 metres (984 ft.). The pointing and training movements, arranged on the left of the frame, permit of the piece being kept constantly trained, so that the elevation can be rapidly effected so soon as the loading is complete. This gives a rapidity of three shots per minute. The field pieces have been designed to meet the new conditions adopted in France. The essential features are lightness, to ensure great mobility, strength sufficient to resist the stresses caused by discharge, and the shock due to transport, the absolute stability giving precision of fire, rapidity of action, possibility of completely changing the point of alignment in a short space of time, effective protection of the parts and the crew from the enemy's fire, and facility of handling and keeping in order. The 75 mm. (3 in.) gun, 30 calibres long, of special cannon steel, consists of a tube, a coil without trunnions, a clamping piece and a threaded collar connecting the two. It fires a projectile weighing 6·5 kg. (14⅓ lb.) at a muzzle velocity of 500 metres (1,640 ft.) per second. The smokeless powder charge is contained in a metal socket let into the rear end of the projectile.

ROUND THE TRADE.

The next sale of guns by Messrs. Debenham, Storr & Sons will take place on the 17th inst.

The firm of Greener is advertising a special high-velocity rifle fitted with a Martini action, which is capable of firing the ·360 and ·375 bore cartridges, the retail price being 10 gs.

The Cotton Powder Co., Ld., have declared an interim dividend at the rate of 7 per cent. per annum on both the preference and ordinary shares for the six months ending October 1905.

Reports have come to hand concerning an influentially backed proposal to form a local Association to promote the formation of rifle clubs in the neighbourhood of the large factories on the Tyne.

We have received a catalogue from the Wilkinson Sword Co., Ld., concerning the sub-target rifle machine, the frontispiece being devoted to an excellent photograph of Mr. A. J. Comber, this year's gold medallist.

We learn from Mr. F. C. Borer that he is now established in offices at 14 Panton Street, Haymarket, and that he is in a position to accept, on agency terms, the representation of one or two firms desirous of extending their business with gunmakers and general dealers in sporting requirements.

Mr. Lincoln Jefferies has introduced in addition to his ordinary type of air rifle a lady's model which is some four inches shorter and one lb. three ounces lighter than the ordinary model. It is of B.S.A. manufacture, and in every respect one of the neatest and handiest air guns we have ever handled.

Sir Andrew Noble in speaking at the annual meeting of Sir W. G. Armstrong, Whitworth & Co., Ld., referred to the recent tendency to cut down the armament of men-of-war to two main calibres. He also called attention to the great success of the firm's manufactures in the recent Russo-Japanese War.

The Text Book of Gunnery, which has now been out of print for some time, represents an important scientific treatise which we can ill-afford to spare. The last edition was published in the year 1902, and we may, therefore, take it for granted that the War Office is hard at work revising a new edition with a view to its publication at an early date.

Page's Weekly contains an interesting illustrated notice of Colonel H. C. L. Holden, of Woolwich Arsenal. It would, however, require more than the small space available in that periodical to give anything approaching a complete summary of the valuable inventions and discoveries of this versatile and above all practical genius, who has done so much to develop ballistic instruments of all kinds.

We understand that Mr. Cartwright's appointment on the staff of the firm of Charles Lancaster has recently terminated. Mr. Cartwright was always noted for his extreme courtesy of manner and the kind personal attention he invariably displayed towards visitors to the above establishment. His long term of service dated from the time when he sold the business which was carried on for so many years by the late Mr. E. Wilson at Norwich.

The *Daily News* has apparently been very severely called over the coals for making certain statements to the effect that the Kynoch Company have sublet a part of the contracts for cordite which they have received from the Government. An ordinary apology having been considered insufficient, the issue of the 19th ult. contained in a prominent column as complete and as absolute a withdrawal and apology as injured feelings could possibly demand.

Various comments have lately appeared in the Birmingham press, relative to the absence of English-made guns at the Liége Exhibition. While this is put forward as evidence of lack of enterprise another aspect of the question may have received first consideration. Belgian gunmakers apart from their skill in manufacture are recognised as very expert copyists. To take coals to Newcastle is in itself a foolish policy, but to take guns to Belgium involves a greater evil than merely attempting to push business in a market already well stocked.

On Tuesday, 31st inst., a summons was heard at Bow Street, before Mr. Marsham in which Messrs. Debenham, Storr & Sons were prosecuted for selling a gun at one of their auctions which had not previously been proved in accordance with the Proof Act, 1868. The defence clearly showed that the breach of law complained of had arisen quite inadvertently and that this firm of auctioneers are in the habit of taking every possible precaution to prevent such mistakes. A nominal penalty of £5, including costs, was considered sufficient under the circumstances, Messrs. Debenham, Storr & Sons promising to exercise increased vigilance in the future.

The sporting papers have lately contained a good deal of matter directed towards examining the sporting ethics of the new Browning automatic shot-gun. The view appears to be held that such a weapon is a game-exterminator of the worst description. The temptation to fire a third shot at game, which has been missed by previous rounds, and which has thus had time to get out of range does not exist with the ordinary double-barrelled fowling piece. Our own experience of the automatic gun has shown that the firing of a third shot at game, is in nine cases out of ten a sheer waste of ammunition. The mechanism of a gun is clearly in need of modification if it encourages the peppering of birds which have got beyond a sporting range.

An opening ceremony somewhat out of proportion to the importance of the occasion took place last month in connection with the inauguration of a miniature rifle range at Messrs. Jaeger's wholesale premises in the City. The actual accommodation available for shooting seems to be satisfactory in all ordinary respects, except perhaps that the platform supports for shooting in the prone position seemed to be of insufficient stability. There is, however, good reason for congratulation in the circumstance that the many clubs which are constantiy being formed give evidence that the movement to establish rifle shooting as a national pursuit is going stronger than ever, and has not fizzled out as so many expected it would when the war excitement had subsided.

At the annual meeting of the Birmingham Small Arms Co., Ld., Sir Hallewell Rogers remarked that the gun department had been well employed during the previous year on productive manufacture, and that there was every hope of keeping the factory fairly well employed for a considerable portion of the current financial year. A large proportion of the increased profits were, nevertheless, due to a considerable increase in the demand for cycle parts. The arrangements to manufacture sporting barrels had resulted in the production of tubes of very high quality, but unfortunately the state of trade had kept the demand very small. The manufacture of air rifles was another new development which it was hoped would prove a permanent and remunerative addition to the business. The rapidly growing demand for rifles of a specification suitable for practice at miniature ranges had not been ignored.

Mr. A. Courtenay Luck has written us a most interesting letter dated from the Arsenal, Zárate, Argentina. After speaking of personal matters, and referring to the magnificent laboratory which is under his charge as Director of the explosives department of the Argentine Government, he goes on to speak in the following terms of the sporting characteristics of the country. He says that the keynote of his adopted country is that English goods are considered the thing, and that money is not begrudged in getting the best. The shooting is excellent, and there should be a good market for English sporting cartridges and first-quality English guns. Those on view in the shops are mostly Belgian and not comparable "to our stuff." Mr. Luck mentions that he took two good-quality guns to Argentina with him, and could have sold them both very easily, they were so distinctly superior to any he had come across locally. It is possible that these few words of advice from a man on the spot may be taken to heart by those of our readers who are in a position to turn them to account.

LECTURES TO YOUNG GUNMAKERS.

XXXVI.—THE RELATION OF RECOIL AND VELOCITY IN SHOT GUNS.

In times gone by a good deal of space has been devoted to showing the mathematical considerations which underlie the calculation of recoil in shot guns. So frequently has the truth that action and reaction are equal and opposite been made clear that the present application of this rule may be dismissed in a very few words. That is to say, the mass or weight of the shot gun in recoil multiplied by its velocity of recoil gives a numerical product which is equal to the addition of the three *mv's* into which the momentum of the ejected products is for convenience divided. The first *mv* is the weight of the shot and the wads multiplied by their velocity of departure from the muzzle. The second *mv* is the momentum of the powder gas at the moment when the shot leaves the muzzle. The weight of the powder charge represents the value of *m*, and the value of *v* is half the muzzle velocity of the shot. This arises from the fact that while the shot charge has passed bodily from the cartridge case to the muzzle, the products of combustion are evenly spread over the whole length of the bore. Their average movement, therefore, is half that of the shot, the velocity being likewise one-half. These two values of *mv* are for convenience sake represented in a combined form. It makes no difference in arriving at the *mv* of the powder gas whether we should take half the velocity or half the weight, the result being the same in either case. The momentum of recoil up to the moment of the shot's departure to the muzzle thus becomes the weight of the shot, plus the weight of the wads, plus half the weight of the powder charge, all multiplied by the muzzle velocity of the shot.

The third factor of the recoil calculation is the momentum of the powder gas in the act of departing from the muzzle after the shot has passed forward. We know the weight of the powder gas, but there is no direct means of measuring the rate of its departure in the form of gas blast. It has, however, been shown in previous lectures that if we measure the recoil of the gun, and set out all the factors showing the momentum of the ejected products, the missing value for rate of gas blast can be deduced. When once this is found, recoil calculations can be most readily effected. The rate of gas efflux so obtained is not by any means an absolute quantity. It is merely a kind of general average expressing the rate at which the gas would need to depart as a self-contained body to produce the recoil known to arise from the particular manner in which it does stream out from the muzzle. Experiments with express and other rifles have shown that each powder has its characteristic rate of efflux, and that this rate is true for all ordinary conditions. Once the rate of efflux has been ascertained the velocity of recoil is derivable from the following formula, which appeared in our lecture of August, 1904. The value 3,000 in the formula is the ascertained rate of efflux for cordite cartridges, and this becomes 1,700 in the case of black powder cartridges:—

$$\text{Velocity of recoil} = \frac{\text{velocity of shot}}{\text{weight of gun}} \times \left\{ \begin{array}{l} \text{weight of shot} \\ \text{and wads and} \\ \text{half the weight} \\ \text{of powder} \end{array} \right\} + \frac{\text{weight of powde}}{\text{weight of gun}} \times 3000$$

The conditions introduced in obtaining similar values for the shot gun with its scattering charge of pellets is far more complicated than in the case of rifles. In the first place the measurement of velocity for a rifle bullet provides consistent readings showing very little variation from round to round. With shot charges on the other hand the velocity varies very considerably owing to the highly variable resistance which the pellets encounter according to whether they traverse the range in close or scattered formation. More than this, there is no recognised formula for converting the mean velocity over a given distance into terms of muzzle velocity. One can only arrive at the last named factor by a very approximate guess. With a rifle bullet, on the other hand, the muzzle velocity which corresponds with the given mean velocity over a certain distance can be ascertained with the greatest exactitude.

It was apparent from the start that in examining the recoil of shot guns, existing methods of test must form the basis of any calculations that may be made. Velocity, for instance, must mean the observed velocity over 20 yards, notwithstanding the fact that recoil calculations would be more consistent if based upon velocity taken over the shorter distance of five yards. Recoil, in like manner, may be regarded from the point of view of the proof gun, which is now generally adopted in this country. When the sporting cartridge is tested it is fired from a gun having a weight of 50 lbs., which swings in the manner of a pendulum on supports having a 5 ft. radius. The distance of backward travel so registered is the measure of recoil. This is translated by means of tables into the particular unit in which the recoil is finally stated for the information of the powder maker or the sportsman. It would be impossible within the scope of this lecture to give anything approaching a full account of the host of experiments from which the information here supplied has been based. Sufficient may however be reported to show that the work performed has advanced our knowledge of smokeless powders to a definite extent. We shall also show how the knowledge so gained can be practically applied.

By examining the results obtained the following values for the rate of efflux as applied to shot guns were duly obtained:—Black powder, 1,700 f.-s.; Schultze, 2,200 f.-s.; E.C., 1,700 f.-s.

We thus see that black powder emerges from the muzzle of a shot gun at the same rate as from a rifle. Schultze powder, on the other hand, has a higher rate of efflux. This may be ascribed to the greater proportion of gas in the products of combustion. E.C. powder, for quite a different reason, has the same rate of efflux as black powder. That is to say the 33-grain types of powder have a lower muzzle pressure, and, therefore, less impelling force to drive the gas from the muzzle at a quickened pace. The above formula of recoil may thus be applied to calculating the velocity of recoil of any weight of shot gun, provided the particulars of the charge are known and the muzzle velocity of the shot can be obtained. In examining a large number of results and making numerous trial calculations, it was found that for ordinary charges it would be quite sufficient to assume that the muzzle velocity of the shot could be obtained by adding 175 f.-s. to the mean measured velocity over 20 yards. The next step was to transpose the above formula so as to supply the calculated velocity

for any given combination of charge from the measurement of recoil first.

Such a process introduces an entirely new factor in shot gun experiments. There are many cartridge loaders who would like to be in a position to measure the velocity of different brands of ammunition, but who are prevented from so doing by the difficulties incidental to the installation and manipulation of a chronograph. The pendulum pressure gun now enables them to register recoil and pressure with a degree of accuracy, leaving little or nothing to be desired. Calculated tables for converting any measurement of recoil into the appropriate velocity for the particular combination of charge used could easily be produced. Before such tables can be built up it is necessary that the underlying arithmetic should be fully justified. It occurred to us that the best means for justifying the mathematical basis of the new kind of calculation would be to give the velocity calculated from the measurements of recoil and in a parallel column the velocity which was obtained from the actual chronographic measurement of the shot in flight. First of all we give the formula by which the velocity of the shot over 20 yards is derived from the known weights of the cartridge components and the ascertained recoil measurement. Thus:—

$$\text{Mean Velocity over 20 yds.} = \frac{H}{A} \times 74284 - \left(\frac{w}{A} \times x + 175\right)$$

Where W = Weight of Powder in grains.
H = Horizontal Movement of Pendulum in inches.
A = Weight in Grains of Shot and Wads and half the weight of powder.

And x Vel. Eff. = Black Powder and E.C. No. 3, 1,700 f.-s., Schultze 2,200 f.-s.

Without further preface we now give a large number of experimental results showing the actual measured velocity on the one hand and on the other the velocity calculated from the measurement of recoil which was made simultaneously with the taking of the velocity.

Schultze 42 grains and 1⅛ oz.

1.	Observed	...	1066 f.-s.	Calculated	...	1075 f.-s.
2.	,,	...	1065 ,,	,,	...	1056 ,,
3.	,,	...	1063 ,,	,,	...	1048 ,,
4.	,,	...	1056 ,,	,,	...	1079 ,,
Av.	,,	...	**1063** ,,	,,	...	**1065** ,,

Schultze 42 grains and 1⅛ oz.

1.	Observed	...	1095 f.-s.	Calculated	...	1072 f.-s.
2.	,,	...	1063 ,,	,,	...	1086 ,,
3.	,,	...	1106 ,,	,,	...	1114 ,,
4.	,,	...	1058 ,,	,,	...	1058 ,,
Av.	,,	...	**1081** ,,	,,	...	**1083** ,,

Schultze 42 grains and 1 oz.

1.	Observed	...	1147 f.-s.	Calculated	...	1168 f.-s.
2.	,,	...	1146 ,,	,,	...	1147 ,,
3.	,,	...	1128 ,,	,,	...	1146 ,,
4.	,,	...	1128 ,,	,,	...	1144 ,,
Av.	,,	...	**1137** ,,	,,	...	**1151** ,,

Schultze 40 grains and 1 oz.

1.	Observed	...	1110 f.-s.	Calculated	...	1110 f.-s.
2.	,,	...	1030 ,,	,,	...	1030 ,,
3.	,,	...	1085 ,,	,,	...	1077 ,,
4.	,,	...	1078 ,,	,,	...	1095 ,,
Av.	,,	...	**1076** ,,	,,	...	**1078** ,,

Schultze 40 grains and 1⅛ oz.

1.	Observed	...	1059 f.-s.	Calculated	...	1045 f.-s.
2.	,,	...	1063 ,,	,,	...	1050 ,,
3.	,,	...	1051 ,,	,,	...	1050 ,,
4.	,,	...	1053 ,,	,,	...	1021 ,,
5.	,,	...	1065 ,,	,,	...	1030 ,,
Av.	,,	...	**1058**	,,	...	**1039** ,,

E.C. 36 grains and 1 oz.

1.	Observed	...	1140 f.-s.	Calculated	...	1190 f.-s.
2.	,,	...	1127 ,,	,,	...	1200 ,,
3.	,,	...	1138 ,,	,,	...	1188 ,,
4.	,,	...	1157 ,,	,,	...	1213 ,,
Av.	,,	...	**1141** ,,	,,	...	**1198** ,,

E.C. 33 grains and 1⅛ oz.

1.	Observed	...	1000 f.-s.	Calculated	...	1020 f.-s.
2.	,,	...	1055 ,,	,,	...	1034 ,,
3.	,,	...	1023 ,,	,,	...	1015 ,,
4.	,,	...	1059 ,,	,,	...	1048 ,,
Av.	,,	...	**1034** ,,	,,	...	**1029** ,,

E.C. 33 grains and 1⅛ oz.

1.	Observed	...	1058 f.-s.	Calculated	...	1062 f.-s.
2.	,,	...	1065 ,,	,,	...	1087 ,,
3.	,,	...	1085 ,,	,,	...	1076 ,,
4.	,,	...	1041 ,,	,,	...	1076 ,,
Av.	,,	...	**1062** ,,	,,	...	**1075** ,,

E.C. 33 grains and 1 oz.

1.	Observed	...	1076 f.-s.	Calculated	...	1068 f.-s.
2.	,,	...	1076 ,,	,,	...	1077 ,,
3.	,,	...	1094 ,,	,,	...	1097 ,,
4.	,,	...	1089 ,,	,,	...	1085 ,,
Av.	,,	...	**1084** ,,	,,	...	**1082** ,,

Black 84 grains and 1⅛ oz.

1.	Observed	...	1082 f.-s.	Calculated	...	1086 f.-s.
2.	,,	...	1069 ,,	,,	...	1085 ,,
3.	,,	...	1061 ,,	,,	...	1097 ,,
4.	,,	...	1054 ,,	,,	...	1073 ,,
Av	,,	...	**1067** ,,	,,	...	**1085** ,,

Upon examining the above figures it will be found that the calculated velocity agrees in so many instances with the measured value as to make the coincidence almost ridiculous. The agreement nevertheless serves the very useful purpose of showing that the system of calculation adopted gives sound results and may accordingly be accepted as having a correct scientific basis. The only instance where anything approaching a material disagreement is to be found is in the combination represented by 36 grains of E.C. and 1 oz. of shot. The observed velocity was 1141 f.-s. whereas the amount calculated from the recoil came to 1198 f.-s. That a similar degree of error does not arise in relation to 42 grains of Schultze and 1 oz. of shot must be assumed to arise from a constitutional difference in the action of the two powders, which renders the one more suitable than the other for calculations based on an empirical factor for velocity of efflux when the velocity reaches an abnormally high level.

While the practical applications of this method of calculation may be postponed for treatment in a future lecture a few words in closing may be devoted to the mechanical methods

of ensuring a true measurement of recoil. When the pendulum gun swings on its pivots the movement is obviously subjected to various frictional resistances which must be eliminated or allowed for if consistent results are to be obtained. When the gun is held in a rear position by a piece of string to an extent representing 10 inches of backward recoil, it may be released without disturbance by burning the piece of string. A few trials will soon show by how much it fails to recover its original position on the return swing. The distance so covered is exactly four times the amount represented by the gun's movement in the act of registering a recoil measurement. Therefore, the correction shown to be necessary by this test is one-fourth the amount so observed. To make the necessary correction the gun when at rest must be set this amount forward of the zero mark as shown on the scale. A material amount of excess friction is introduced by the energy required to push the recording slide along the scale. This source of friction may be almost eliminated by setting the slide at 10 inches when recoils of over 10 and under 11 inches are anticipated, and in like manner for other measurements according to the reading expected. When these precautions are taken the amount of recoil registered comes exceedingly near to the amount recognised as standard for the particular combination of charge which may be under examination.

Another fatal source ot error to which special attention should be paid by every user of a pendulum proof gun is the possibility that the weight of the gun may be only approximately 50 lbs. Every gun must be carefully weighed, and the surplus metal adjusted so that the nett. weight of the gun and half the weight of the moving parts of the suspending apparatus will make up a total of 50 lbs., neither more nor less. While this aspect of the question relates more properly to the laboratory than the scientific education of the gunmaker it is mentioned because users of the new pendulum gun who may desire to repeat the above experiments and calculations may find discrepancies. These they may feel inclined to attribute to mathematical fallacies in our work whereas they may be wholly due to lack of taking the requisite precautions.

INTERIOR BALLISTICS.

PARTS I and II of the *Mémorial des Poudres et Saltpêtres*, Vol. 13, has been recently issued and consists namely of a treatise on interior ballistics by *MM.* Gossot & Liouville. The title of this technical article which covers 140 pages may be translated as "The Ballistic Effects of Smokeless Powders in Guns." The authors explain in their introduction that it was the intention of M. Sarrau to write the present treatise and thus bring his previous work to a fitting conclusion. Unfortunately death prevented the accomplishment of this scheme. No one has done more to place the theory of explosives on a sound basis than Emile Sarrau. His recent works were no doubt part of a comprehensive scheme, and the treatise under review completes the programme. In 1892 he published his "Introduction to the Theory of Explosives," a book of a highly theoretical character dealing with the dynamics and thermodynamics underlying explosive action. Two years later there followed a book on explosives proper, termed "The Theory of Explosives." This work explained the action of explosives in general and the methods for calculating temperature of combustion. It might be taken as covering the action of blasting explosives. To complete the series a work on the action of explosives in guns was necessary, and while we regret that Sarrau was not permitted to complete his work, we must cordially welcome the issue of the third and concluding volume of what we regard as the most thorough and able exposition of explosives theory. In these books the subject is treated in a most exact and definite manner, making the subject uninteresting except to those possessing a fair knowledge of mathematical analysis.

The science of interior ballistics may be regarded from two points of view. One as a discipline to train the mind properly to appreciate the value of the elements which may vary either in the gunpowder or in the bullet or gun. On the other hand it may be taken merely as a means to an end, namely the calculation of pressure and velocity in rifled arms and pieces. The former is to our thinking by far the more important aspect of the subject, and as such its usefulnes is undoubted. Interior ballistics as a discipline must be expounded on sound principles involving the established theorems of dynamics and thermodynamics. This rigour is not so essential when the calculation of results is alone required. For this purpose purely empirical formulæ can with advantage be used, in fact such formulæ are the more reliable because they are based on firing results which include in their limits the actual calculation.

The treatment of interior ballistics in our government text books is on empirical lines, and a very poor sample of this. It is remarkable that serious publications on this subject in England are almost limited to Mr. Longridge's effort of 1889. In America they have done a little better. Capt. Ingalls of the U.S. Navy has written useful books, and Lieut. Glennon's *Interior Ballistics* is quite a good work, spoilt only by the author's retention of English weights and measures in the development of his expressions. The really good books on this subject have emanated from France, provided we exclude Capt. Halsen's excellent *Cours de Balistique Intérieure*, published by Alfred Castaigne of Brussels.

MM. Gossot & Liouville's work is on the same lines as Sarrau's *Powders and their Effects*, published in 1873, but with the advantage of later researches and dealing exclusively with smokeless powders. It is quite impossible in a review to give a reasonable presentation of their methods, it is the latest work on the subject and quite the best. We cannot do more than recommend it to all students of interior ballistics.

AIR-GUN DEVELOPMENTS.—The B.S.A. Company have now issued a very interesting descriptive pamphlet giving particulars of the various items of the design of their new air-rifle. It is very interesting to read that they consider the Witton slug far and away the best model to adopt for rifled barrels. A diagram showing this slug on an enlarged scale gives the forward diameter as ·178 to ·180 in., and the size of the back as ·183 to ·186 in. We are glad to note that the above company have taken the open sight seriously, instead of leaving it to be replaced with an aperture sight should a high grade of accuracy be required. The shooter has the choice of six forms of notch in the backsight and four different tips to the foresight. From amongst these he should at least be able to select something suitable.

TESTING EXPLOSIVES.*

THE author of the work before us is the Managing Director of the Carbonite Explosives Co., Ltd., Hamburg. By placing before the world the result of his researches he has proved his right to be considered a true scientist. When a manufacturer publishes information which is useful to his competitors he rightly wins the admiration of the public and distinguishes himself at once from the commercial man with sordid interests. Such a worker belongs to those who have made our civilization by adding to knowledge for its own sake.

The book under review relates only to the testing of blasting explosives. To say that it consists of only 62 pages and four tables is to give a poor idea of its value. Its pages bristle with suggestions and actual experimental results to an extent seldom found in a volume of five times its size. To manufacturers of explosives and the expert alike the book will be found useful, not only on account of the experimental results given, but also because these results are really only examples of the rules which apply to the behaviour of all explosive agents. We cannot pretend to review the book in detail, but there are a few points which may be selected as of special interest to our readers.

For some years our authorities have passed and approved explosive mixtures for blasting before permitting them to be used in mines. The test consists in firing a given charge from a cannon which projects the tamping and hot gaseous products into an inflammable mixture of gas. We are told by Mr. Bichel that all explosives, if used in sufficient amount, will ignite pit-gas and coal-dust and that it is really a question of the limit of this permissible quantity. Thus, under certain conditions of test, as small a quantity as 5 grammes of dynamite, black powder and similar explosives will cause ignition whilst as much as 1,000 grammes of carbonite and similar explosives fail in this respect. This firing limit has been appropriately termed the "*charge-limite*." Naturally the *charge-limite* depends on the conditions of test, but the relation for a given method appears to hold. The authorities in the different countries, one would think, ought to adopt the same method, so that the results might be more easily compared. Certainly it seems to us that a far better method of test is to state what amount will fire inflammable gases rather than saying that a particular explosive passes a given test. Users would have, with the *limit charge*, an idea of how near the wind they sailed.

It is interesting to find, in the experiments reported, that the closed chamber pressures are in close accord with those calculated from the established rules explained in these columns. A method is introduced for estimating the effect on maximum pressure due to cooling. Charges were fired in bombs of the same capacity but with internal surfaces varying in the relation of one to three, and by extrapolation the true pressure obtained. This provides a correction for closed chamber pressures which probably explains why theory and practice are so near.

Mr. Bichel argues that we have in what he calls the "*Afterflame Ratio*" a true criterion of the safety of an explosive for fiery mines. The *afterflame ratio* is the relation of the duration of the flame of a given charge to the time of its detonation. The difference in the ratio between explosives known to be unsuitable for mines and those in general use is very great, and there appear to us good reasons for regarding this ratio as an index of the safety of an explosive. Unfortunately its determination is a matter of some difficulty because it involves the estimation of the rate of detonation and the duration of the flame, so that we fear it is never likely to be adopted generally as a test of suitability of a particular explosive mixture.

We cannot close this review without making special mention of Mr. Axel. Larsen, the translator. In editing the original serial reports he has given us not only a useful but also a very readable book, he being gifted with the very exceptional power of writing an acquired language in perfect style.

* By C. E. Bichel. Translated and Edited by Axel. Larsen, M.Inst.M.E. Published by Charles Griffin & Co., London.

CADET RIFLES.

SIR,—In your article entitled as above, you remark *re* the ·22 long-rifle cartridge that this cannot be withdrawn from the chamber without very frequently leaving the bullet still in the barrel. This is quite true of the usual long-rifle cartridge, but if you want a cartridge with the shell crimped on to the bullet this can now be got, the Peters Cartridge Company, of America, having brought one out early this year. I enclose a cutting from *Shooting and Fishing*, of February 9th last, giving an account of this, and by the diagrams made it is quite as accurate as the uncrimped cartridge. It has the 40-grain bullet. Regarding the necessary size of chamber, etc. and twist of rifling, surely this should be well enough known now when you consider the millions of ·22 cal. rifles that are in use. If you want a rifle that will shoot the short as well as the long-rifle cartridge, a 1-in-17 twist is generally acknowledged to be the best, but personally I do not believe in making a rifle to fire two sorts of ammunition. I would prefer making it fire the ·22 long-rifle as accurately as this ammunition can be made to shoot, and a 1-in-16 twist is best for this purpose. If the short cartridge is used a trifling loss of accuracy is experienced. I think it would be better if the Government adopted the long-rifle cartridge and only issued the one brand. The best system of action to eject the ·22 shell is no doubt the bolt one, as on the service rifle. This can be made easily removable for inspection and cleaning, without having to take the barrel off, as is necessary with the Martini. I quite agree with you that a long barrel, say 28 inches, with an open wind-gauge rear sight, should be used; so that the sights can be nearly as far apart as in the service weapon. The weight should be about 7½ lbs, and the trigger-pull, say 6 lbs.

Regarding the cartridges, these should certainly be loaded with smokeless powder, as this makes so much less noise in an enclosed space, such as a drill hall or indoor range. A great number of smokeless cartridges can be fired without cleaning. I have seen over 200 fired out of a ·22 rifle without cleaning, and it was quite as accurate then as at the start, while with black powder the rifle must be cleaned every 20 or 30 shots to make good shooting. Another advantage would be to have the bullets of the ungreased sort, like the Winchester ·22 short and ·22 automatic cartridges. I understand a thousand of the latter have been fired without cleaning the rifle and no loss of accuracy occurred.

Yours faithfully,

C. H. MANN.

APPLICATIONS FOR PATENTS.

SEPTEMBER 18—OCTOBER 21, 1905.

18,810.* Small-Arms. F. Jäger. (Date of application in Germany September 17, 1904)
18,898.* Ordnance Projectiles. Fried Krupp, Ag. (Date of application in Germany, December 8, 1904).
18,977. Projectile Fuses. H. Stanbridge.
19,112.* Manufacture of Explosives. J. C. Smith.
19,166. Telemeters. A. König and E. Dönitz.
19,332. Gun Rack. W. Thear.
19,336.* Small-Arms. J. W. Esser and G. W. and F. Barrett.
19,402.* Percussion Caps. F. Gehre.
19,434.* Ordnance Recoil Brakes. Fried Krupp, A.G. (Date of application in Germany, December 27, 1904).
19,513.* Firearms. E. H. Serle. (Date of application in U.S.A., October 1, 1904).
19,577. Ordnance. T. A. Pool.
19,604.* Mine Finder. U. S. Sjöstrand. (Date of application in Sweden, October 14, 1904)
19,740.* Torpedoes. V. E. von Pebal and F. Fuchs.
19,780. Explosives. R. Holliday & Sons, Ld., and J. Turner.
19,842.* Eliminating Smoke from Ordnance. C. V. Alsop.
19,893.* Safety Device for Small-Arms. J. Tambour.
19,956. Armour Piercing Projectiles. C. F. Hatton.
20,181. Range Finders. J. Formby.
20,238. Grenades and Shells. B. Pedersen.
20,239.* Safety Device for Small-Arms. J. Tambour.
20,304. Torpedoes. S. Brotherhood and C. W. Bryant.
20,305. Ordnance Mountings. Sir W. G. Armstrong, Whitworth & Co., Ld., and R. Wright.
20,310.* Nitroglycerine. C. L. Reese.
20,316. Machine Gun Beltless Attachment. W. Willoughby.
20,455.* Ordnance. Fried Krupp Ag. (Date of application in Germany, December 29, 1904).
20,479. Slugs. H. H. Lake. (Agent for *American Ball Co.*)
20,487.* Submarine Mines. G. Sautter, E. Harle, and J. Rey. (Date of application in France, October 13, 1904).
20,725.* Shooting Range. W. V. Jones and D. Hilderini.
20,774. Projectile Fuse. A. T. Dawson and G. T. Buckham.
20,782.* Automatic Firearms. O. Imray. *(Agent for Colt's Patent Firearms Mfg. Co.)*
20,889. Ordnance. L. Newitt.
21,036.* Ordnance. E. J. Blood.
21,176. Torpedo Propellor. S. U. Hardcastle.
21,340.* Gun Carriage. Fried Krupp, Ag. (Date of application in Germany, February 23, 1905).
21,350. Double-Barrelled Small-Arms. J. Carter.
21,354. Aiming Tubes for Heavy Ordnance. A. T. Dawson and G. T. Buckham.

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

SEPTEMBER 28—OCTOBER 19, 1905.

COMPILED BY HENRY TARRANT.

17,524 (1904). **Range Finder.** Lieut. E. Schmalz, Austria. The range finder described in this specification is an improved type of another set out in Patent No. 11,902, 1891. All the more important problems admit of direct instrumental solution, whilst the remaining problems connected with working out the range may be solved through this telemeter in a simple manner without resort to delicate auxiliary instruments. Accepted September 11, 1905.

19,670 (1904). **Saloon Rifle.** F. Linner, Austria. A saloon rifle, from which bullets are expelled by a hammer under strong spring influence, is constructed to carry a number of projectiles in a magazine beneath the barrel. The hammer also controls the feed of the bullets one by one to the barrel. Accepted September 7, 1905.

20,779 (1904). **Projectile Fuses.** Col. H. C. Seddon, West Kensington. A further development of the safety device for fuses described in Patent No. 16,000, 1904, is set out in this specification. The firing pellet is held securely until the projectile has left the gun by a bow-spring, which engages indents in the inner wall of the fuse; or by balls which cannot shift until the full pressure is removed. Accepted September 27, 1905.

20,802 (1904). **Telescopic Sights.** T. E. Bousfield (Agent for *A. Salmoinaghi, Italy*). In order to eliminate the disadvantage of displacement connected with an ordinary cross-wire telescopic sight, the patentee rigs up an ordinary telescope behind the rear sight which is represented by a lens. The focus of this lens coincides with the metal foresight. Accepted September 21, 1905.

23,366 (1904). **Priming Composition.** The King's Norton Metal Co., Ld. T. A. Bayliss and H. W. Brownsdon, London. To the ordinary substances used as the igniting material in percussion caps or detonators is added a powdered metal held in suspension by shellac varnish. Aluminium is preferably employed. It enhances the temperature on detonation, and the varnish prevents any chemical action between the metal and the ordinary priming compound. Accepted September 14, 1905.

23,962 (1904). **Fuse for Projectiles.** R. Sohlman, Sweden. A percussion fuse designed especially for use with shell charged with picric acid is described in this patent. The detonating charge is so arranged that sufficient delay is caused to allow the projectile to get through an armour plate before the shell is exploded; and in case of a part being torn away another part of the fuse still links the detonator to the charge proper. Accepted September 7, 1905.

24,658 (1904). **Rifle Magazine Mechanism.** Fabrique Nationale d'Armes de Guerre, Société Anonyme, Belgium. In order to shut off the cartridges in a magazine of the tubular type, a small two-armed lever is arranged so that it may be operated by the fingers to press back the foremost cartridge until it is out of reach of the charger. The weapon may be used then as a single loader, without interfering with the magazine supply. Accepted September 7, 1905.

24,659 (1904). **Safety Device for Small-Arms.** The Fabrique Nationale d'Armes de Guerre, Société Anonyme, Belgium. Instead of arranging the trigger-locking bolt on the top strap of the action, it is situated inside the forward part of the trigger guard. The finger which pulls the trigger is thus adapted to operate the device practically without any extra movement. Accepted September 7, 1905.

25,003 (1904). **The Propulsion of Torpedoes.** Sir W. G. Armstrong, Whitworth & Co., Ld., and W. H. Sodeau, Newcastle-on-Tyne. In Specification No. 10,126, 1900, is described a method of enhancing the amount of work obtainable from the charge of compressed air stored in the reservoir of a torpedo, by burning inside the reservoir alcohol or petroleum. The present patent deals with a method of feeding the alcohol progressively into the air chamber. Accepted September 21, 1905.

25,609 (1904). **Automatic Rifle Mechanism.** M. F. Smith, U.S.A. In this specifiation is fully set out and illustrated a combination of parts adapted to be worked on the known principle by the gases of combustion. Certain novel features are described, the more important of which are the magazine and initial loading devices. Accepted September 7, 1905.

26,135* (1904). **Rifle Bolt Mechanism.** J. B. Thorneycroft, Mauchline, N.B., M. G. Farquhar, Aboyne, N.B., and A. H. Hill, Birmingham.

26,146* (1904). **A High Explosive.** Curtis's & Harvey, Ld., London, and A. F. Hargreaves, Roslin, N.B.

26,480 (1904). **Range Finder.** Lt.-Col. R. H. Owen, New Zealand. The principle of calculation upon which the construction of this range finder is based consists in the fixed proportions existing between the sides of triangles having the same angles. A basic triangle is first obtained having a fixed base, and a second triangle, one of the sides of which is the distance computed is then obtained upon a measured base with angles similar to the basic triangle. The sides of the second triangle bear the same relation to the base as do those of the first triangle. Accepted September 21, 1905.

27,005 (1904). **Priming Composition.** J. Wetter, London (Agent for *Westfälisch-Anhaltische Sprengstoff Ag., Germany*). A priming composition, one example of which is:—Ful-

minate of mercury 36 parts, Chromate of lead 40 parts, Sulphide of antimony 20 parts, and Pulverised glass 4 parts. The chromate of lead is added in order that the oxide of the metal and the chromic oxide yielded upon detonation may adhere to the gun barrel interior and so form a rust preventative. Accepted September 14, 1905.

28,256 (1904). **Ammonium Nitrate Explosives.** N. Ceipek, Austria. In the manufacture of explosives of the ammonium nitrate class an amount of picric acid which falls within 7 per cent. and 10 per cent. of the mixture is added to the other ingredients. The safety of the explosives is increased by an addition of such proportions whilst its power is enhanced. This matter was referred to in a former Patent No. 21,627, 1900. Accepted September 21, 1905.

1416* (1905). **Manufacture of Nitroglycerine.** E. Hesketh, London, and F. A. Wilcox, Sunderland.

5,994 (1905) **Telescopic Sights.** A. J. Boult. London. (Agent for *Dr. F. A. Schanz, Germany).* In order to obviate the disadvantages in telescopic sights due to the facts that the available sighting distance is short and that the telescope is supported at only one point, the telescope is mounted on a frame, and the front sight which consists of a mirror is caused to reflect the image of the sighting mark situated beneath the telescope. The sighting distance is by this means lengthened, and the movements of the telescope do not effect the position of the sighting line. Accepted September 14, 1905.

10,108 (1905). **Night Sights for Small-Arms.** Capt. G. Daningle, Austria. By means of a device consisting of a tube adapted to be fixed upon the barrel of a small-arm the object may be illuminated when shooting at night. The tube contains a reflector, an incandescent electric lamp and an adjustable convex lens. The reflector is so arranged that it may be adjusted to insure that the line of light shall be parallel with the line of sight. Accepted September 7, 1905.

10,453 (1905). **Grenade Shell.** Col. W. J. Fowler, Martyr Worthy, near Winchester. This patent deals with grenades of the type set out in Specification No. 4,585, 1900. A shell of ordinary construction is loaded with a number of smaller shells which are arranged around the central pillar of the main shell. These inside shells are provided with fuses of different lengths, so that they shall not all explode simultaneously. Accepted September 14, 1905.

11,002 (1905). **Air Gun Pellet Re-sizer.** L. Jeffries, Birmingham. A hand tool, which follows the form of a pair of pliers, is provided at one nose end with a cone head and at the other nose end with a socket or box. An air gun pellet is introduced into the socket and is speedily pressed into shape when the noses of the pliers are forced together. A spring piston is pushed to force the pellet out of the socket. Accepted September 14, 1905.

11,400B (1905). **Safety Device for Small Arms.** J. Robertson, London. An improved form of the safety device set out in Patent No. 18,135, 1895, is described in this specification. To a pivoted part adapted to lock the sears are added two fingers which are designed to return this pivoted locker to its central position when the locking bolt is next operated after one barrel has been discharged and subsequently re-charged. Accepted September 7, 1905.

11,672 (1905). **Cartridge Carrier for Small-Arms.** W. A. Sparks, U.S.A. Beneath the forepart of a small-arm is fixed a tube within which is arranged a spring-operated plunger. The tube is filled with cartridges and these are held therein against the pressure of the plunger by a twisted wire device which will, when turned, release the foremost cartridge but hold the cartridge next in succession. The cartridges may in this way be taken out one by one for loading by hand into the weapon. Accepted September 14, 1905.

14,545 (1905). **High Explosives.** Marquis Roberto Imperiali, Italy. An explosive compound of very high power is fashioned as follows. Nitrate of ammonium 74 parts by weight, sulphide of antimony 6 parts by weight, and dinitrobenzene 20 parts by weight. These substances are mixed together when perfectly dry, and are afterwards subjected to a temperature of 100 deg. at which point the dinitrobenzene melts and covers every particle of the explosive. This coating acts as a protection against moisture. Accepted September 14, 1905.

15,583 (1905). **Ordnance Brake Mechanism.** Fried. Krupp, Ag., Germany. This patent refers to barrel recoil mechanism provided with that type of device for securing the brake cylinder to the gun and for mounting the running-out spring described in Patents Nos. 16,048, 1901, and 3,970, 1905. The object of the present invention is to arrange for conveniently filling in and replenishing the brake fluid. Accepted September 14, 1905.

* These Specifications are more fully described under "Selected Patents."

SELECTED PATENTS.

MANUFACTURE OF NITROGLYCERINE.

1416 (1905). E. Hesketh, London, and F. A Willcox, Sunderland. For the purposes of cooling and agitating in the nitration and separation processes in the manufacture of nitroglycerine, and for agitating in the operation of mixing the acids, a current of compressed atmospheric air has been employed. The above patentees modify these agitating and cooling operations by using compressed air which has been deprived of moisture and reduced to a low temperature by passing it over the evaporator coils of a refrigerating machine.

The employment of this modification in the manufacture of nitroglycerine obviates certain disadvantages. When mixing the acids the moisture in ordinary atmospheric air has a tendency to dilute the acids, and also to produce heat by combining with the sulphuric acid. By using refrigerated and desiccated air there is no tendency to dilution, and the heat produced by the mixture of the sulphuric with the nitric acid is not increased by chemical action between the air and the acids. On account of the air being cold, the acids are quickly cooled to the required temperature, and less air is, therefore, required. In the nitrating process the chemical action is controlled by cooling the mixture through the medium of refrigerated water run in coil in the nitrating tank, the contents of which are agitated by compressed air. To the separation process these improvements also apply. Accepted September 7, 1905.

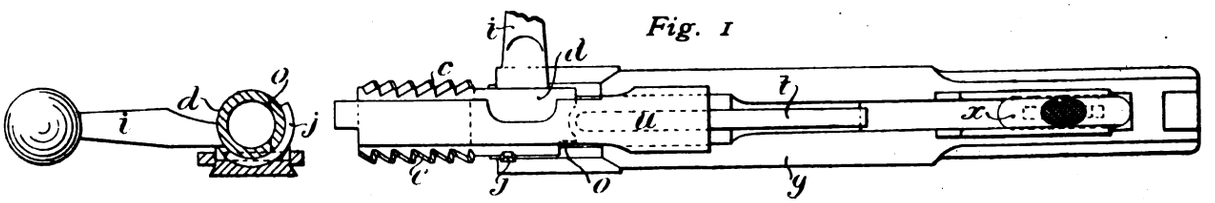
A HIGH EXPLOSIVE.

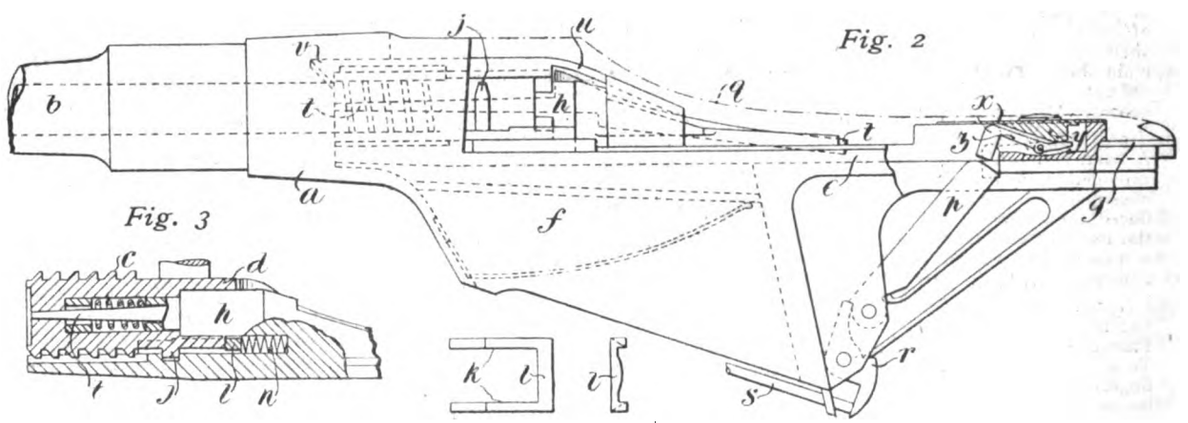
26,146 (1904). Curtis's & Harvey, Ltd., London, and A. F. Hargreaves, Roslin, N.B. The patentees have produced an explosive which can be ignited like ordinary gunpowder, but is capable of exerting under the necessary confinement or pressure a disruptive energy more nearly approximating that of a member of the detonating class of explosives. A detonating explosive is combined with a non-detonating one, but not after the various methods which have already been suggested.

Ordinary gunpowder is first made of the usual proportions of saltpetre, charcoal and sulphur, i.e. 75 parts, 15 parts and 10 parts respectively. These are thoroughly incorporated and are made into grains of such a size that the whole passes an 11 mesh sieve and is retained on a sieve of 28 meshes to the inch. The constituents above may of course be varied to suit different conditions always provided that the mixture does not depart from the gunpowder class. Two modifications are as follow:—(1) Potassium nitrate 78 per cent., charcoal, 17 per cent., sulphur 5 per cent.; (2) potassium nitrate 40 per cent., barium nitrate 40 per cent., charcoal 15 per cent., and sulphur 5 per cent. In both of these the saltpetre is displaced by other nitrates. The main consideration in selecting this gunpowder compound is that it shall be of such a character that it will readily ignite by a spark or flame from an ordinary fuse.

The detonating explosive is built up by combining potassium or barium nitrate with any nitro derivative of benzene, toluene, napthaline, phenol, or any mixture of these. Dinitrobenzene,

dinitrotoluene, trinitrotoluene, mononitronapthaline, dinitronapthaline, picric acid and picrate of ammonia are each suitable for the purpose. The proportion of potassium or barium nitrate to any of the above nitro derivatives is fixed in such a manner that the carbon and hydrogen contained in the latter will be furnished with sufficient oxygen from the nitrates of potassium or barium for their full oxidation to carbon dioxide and water, so producing the maximum thermal value. A lower temperature may be produced by limiting the nitrates of potassium or barium to such an extent that the carbon will be wholly or partly oxidised only to carbon monoxide. For shells or general rock blasting the following are the proportions:—Potassium nitrate 75 parts, and dinitrotoluene 25 parts; or potassium nitrate 70 parts, dinitrotoluene 20 parts, trinitrotoluene 10 parts. The trinitrotoluene is first melted, and the finely powdered potassium nitrate is slowly added. The mixture is then passed through a coarse sieve. The most suitable size of grain is that which passes through an 11 mesh sieve but not through a 36 mesh sieve. The grains of this explosive are then mixed with those of the gunpowder in equal proportion by weight. When ignited the gunpowder develops sufficient pressure and heat to cause the detonating substance to explode violently. Accepted September 7, 1905.





RIFLE BOLT MECHANISM.

26,135 (1904) J. B. Thornycroft, Mauchline, N.B., M. G. Farquhar, Aboyne, N.B., and A. H. Hill, Birmingham. An improved magazine rifle bolt action, of the type described in Patent No. 14,622, 1901, is dealt with in this specification. The overall length of the rifle is reduced by projecting the magazine and action into the stock.

The mechanism is illustrated in the appended drawings. The body *a* (Fig. 2) is adapted to receive the parts and is attached to the barrel *b* as is shown. The body is provided with internal screw threads or recesses which are designed to take the interrupted screw or lugs *c* formed on the bolt *d*. The bifurcated guide plate *e* straddles the magazine *f* and extends horizontally over the top of the stock rearward of the grip. In this guide plate *e* the combined magazine cover and bolt carrier *g* slides The forward end of the carrier *g* terminates in a stem *h* on which the cylindrical bolt *d* is adapted to rotate when turned to engage the screw threads *c* with the threads in the body *a*. The bolt is turned by means of the handle *i*, and it is secured to the stem *h* by means of a pin and slot connection, or by the rib *j* which allows of rotation of the bolt when in position for closing the breech. When withdrawn the bolt is locked against rotation by the forked catch *k*, the cross-bar *l* of which is pressed by a spring *n* (Fig. 3) into engagement with a flat face *o* (Fig. 1) formed near the rear end of the bolt. The forwardly projecting forks of this locking catch strike a part of the body *a* when the bolt is pushed home and are drawn back against the pressure of the spring *n* to release the bolt and permit of its rotation.

The guide plate *e* and the carrier *g* are sunk below the centre line of the barrel, and this depression, coupled with the absence of the usual cylindrical bolt guide, permits of the use of the weapon without undue elevation of the sight above the barrel *b*. The bolt carrier and the hammer *p* are enclosed by a light cover *q*. The hammer is cocked by the bolt carrier when it is retracted, and it is held in the cocked position by the sear *r*. When the trigger is pulled the hammer is released through the medium of the rod *s*. The falling hammer strikes the firing pin *t* and so discharges the cartridge. The shield *u* limits the movement of the firing pin, and has on its forward end the extractor *v*. A tail piece is formed upon the carrier *g*. This abuts against a spring stop at the rear of the action, and prevents unintentional withdrawal of the bolt. The safety *x* carrying the wedge-shaped part *y* is adapted to operate the top arm of a small beam lever *z*. The arm is depressed by the forward movement of the safety *x*, and the hammer *p* is locked by it in the cocked position. When the slide is carried rearwards by the thumb, the other arm is engaged by the wedge-shaped part and the locking restraint of the top arm is removed from the hammer. The magazine is of an ordinary type and contains a platform cartridge feeder which is pressed upwards by a spring. Accepted September 21, 1905.

Arms & Explosives

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CONTENTS.

CURRENT TOPICS.

The Official Cadet Rifle.—We have received an intimation from the War Office that samples of the proposed cadet rifles are expected shortly from the manufacturers. Such an announcement seems to carry with it evidence of a highly praiseworthy degree of despatch on the part of an office which is usually hampered in giving prompt effect to a public demand. It certainly says a great deal for the enterprise of our manufacturers that they should be in a position at such short notice to supply samples of a model of rifle which to say the least is not an article in current demand. However, it will be time enough to congratulate the War Office on its promptness when the first samples of the new cadet rifle are available for distribution. Between the submission of samples and the sealing of a pattern many experiments must be conducted and sundry doubtful questions must be debated. The delays incidental to manufacture can be estimated in advance with a reasonable amount of certainty. It should take not more than from three to six months to make the necessary gauges and tools which precede output on a manufacturing scale. Extra delay can only arise in the event of modifications in the design of the sealed pattern. The success of the rifle club movement will be largely influenced by the quality and characteristics of the new rifle. The gun trade will in like manner have a very important stake in the success of the new measure. If the action to be fitted to the new rifle proves a successful piece of design, and applicable to firing a variety of cartridges, its original function as the basis of a cadet rifle will be extended in a host of new directions. Assuming that its manufacture is exclusively carried on by private firms the gun trade will be able to buy an all-English rifle which will be susceptible to re-sighting, re-adjustment and general modification to suit a variety of needs. Colonial trade will again be capable of an indefinite amount of development by reason of the sentimental favour with which any piece of British workmanship is regarded. More than this we have lately enjoyed the benefits derived from the carrying out of a large amount of shooting on a somewhat novel basis. That is to say we have been at work endeavouring to reproduce in miniature rifle shooting as many of the elements of military marksmanship as can be incorporated into short-range practice. The outcome of such work has naturally been to point the way to a somewhat specialised design of firearm which may occupy a position in the world's markets rather different from that of anything at present in vogue. The new rifle, supposing it properly fulfils its intended functions, should exercise an immense influence on the fortunes of the gun industry in respect to a department of manufacture which we have hitherto allowed to pass by. Others may copy the outcome of our endeavours; but we have the important advantage that the rifle which we may put forward will possess the recommendation of Government sanction and approval.

Standardisation in Manufacture.—At a congratulatory dinner recently held in London to celebrate the past year's successes on the part of the Daimler Motor Car Company, the general manager, who is a talented engineer of American nationality, attributed the greater part of the success achieved to the systematic standardisation of design and processes. When such an announcement is followed by an all-round reduction at the approximate rate of £130 on each type of car it must be recognised that the principle of standardisation has found a clever exponent. It is easy enough to recommend the gun-

maker to follow suit, but such advice lacks soundness if it is given without a full appreciation of the practical conditions. The gun as it stands contains hardly a straight line and seldom two surfaces at right angles to one another. Very few of its component parts could be readily fashioned by machinery to produce the required effect without aid from hand workmanship. Nevertheless the principle of standardisation may always be applied, provided the method be sufficiently elastic to take account of all aspects of the problem. In the matter of the barrel we have an excellent instance to illustrate our meaning. To-day it is possible to buy a pair of B.S.A. tubes of the highest quality and ready for immediate assembling in the double-barrel form. Such tubes cost but ten shillings a pair, and the value for money they represent is entirely due to a process of standardisation. No longer do we hear the complaint that the barrel trade is ruined by foreign competition, and that the reputation of the English gun suffers by the purchase of a vital component from foreign firms. Much the same kind of result can be attained by each individual manufacturer if he sets to work to cut down needless variations and concentrate attention on the improvement of each manufacturing process. Though machine operations are generally regarded as the kind which are most suitable for constant repetition of a single process, manufacturers recognise that the human body must also be regarded as a machine which is capable of extraordinary rapidity of output when restricted to the performance of a circumscribed routine. Although the gun is thus admitted to be less susceptible than almost any other piece of mechanism to modern engineering developments it is certainly true that it can participate in an ever-increasing measure in the benefits rendered available by mechanical progress in other directions.

A Departure in Rifle Targets.—The National Rifle Association, after fighting for many years against the principle of utilising for ordinary competitions the inner circle within the bull, have at last made a graceful surrender. The most skilful aligner of the rifle in the whole world is probably the gunmaker's "man at the ground," who tests the firm's output by means of an ordinary table rest. The quality of the groups which these men produce at all times and all seasons of the year is only fully appreciated by those who meet them during the round of a day's work. Such experience as these men have gained must accordingly be regarded as representing the last word that can be said concerning the more permanent problems of rifle alignment. While the Bisley marksman is called upon to shoot at a circular bull having a diameter proportional to 7 inches at 200 yards, the gunmaker's shooting man employs a square bull with 10-in. or 12-in. sides to produce the best results in the way of fine shooting. The difference of area between a seven-inch circle and a twelve-inch square is so obvious that the point need not be argued. The principle involved is that the progressive reductions in the size of the Bisley target have produced a double effect. The smallness of the bull has diminished the scoring area, thereby making full scores more difficult of attainment. The second result, which is not so generally appreciated, is that the undue lessening of the black surface has introduced difficulties of vision sufficient to cause abnormal errors of alignment. It has at last been recognised that the limit of bull's-eye reduction has been attained without producing the desired effect of diminishing ties. The N.R.A. Committee have accordingly abandoned the old system of bull in its entirety, having adopted in its place a twelve-inch circle of black containing a five-inch inner circle, the latter counting for scoring purposes as the bull. The outer ring thus constitutes the inner, and a single circle outside the black constitutes the magpie ring. Although this modification has so far only been introduced with reference to the 200 yards target, there can be little doubt that it will in due course be extended to other ranges. It is of course unlikely that the long-range targets at 800 yards and beyond will be influenced by the change. Full scores at such distances are by no means easily attained, and the size of bull has accordingly been allowed to remain a sufficient size. More than this the limitations which obviously govern the total size of the target must necessitate an even distribution of the available area as between the portions coloured black and white respectively.

The Chamber of Commerce Meeting.—It is not by any means certain that gunmakers will welcome with any degree of effusiveness the steps taken by the Chamber of Commerce to call a meeting to discuss trade troubles and grievances. The programme which has been outlined certainly fails to indicate anything in the nature of desirable action. That the abolition or reduction of the gun licence will naturally take a prominent position is not suggestive of brilliance or originality. The Gun Licence Act so far as it restricts the use of guns is virtually a dead letter. When Saturday night displays the local policeman conscientiously parading a street containing a portable shooting booth mounted on a costermonger's barrow one is apt to wonder whether he realises that there is a clause in the Gun Licence Act forbidding the use of guns within 50 yards of a highway. The Government very kindly released from the restrictions of the Gun Licence Act all users of fire-arms in a club sense. This, combined with a gradually extending definition of the word "curtilage," so that it now apparently includes the entire area of Great Britain, means that the Gun Licence Act is now limited in application to the man who shoots rabbits with a shot gun. A modest estimation of the evasions committed in this respect would fall little short of 50 per cent. Such a question as the institution of rifle clubs in schools, large industrial establishments, and generally throughout the country is another item of propaganda which will not be condemned by persons who systematically oppose startling innovations. The inauguration of rifle clubs is so essentially a public matter that it would suffer very seriously from interference by an interested party acting from interested motives, however well-intentioned such meddling might be. The gun trade will long remember the lack of success which attended the effort to introduce clay bird shooting as an English pastime. The thousands of pounds which were disbursed upon efforts to produce the required result proved quite unavailing; and yet there developed simultaneously and entirely without artificial stimulus the shooting school system of clay bird practice for which public opinion was ripe and ready. Much as we have at heart the prosperity of the gun trade, we cannot help feeling that such troubles as may surround it are of an ordinary trade character, and not open to amelioration by heroic measures, always of course excluding the political aspect of the question as embodied in the Chamberlain doctrine.

THE BROWNING CONTROVERSY.

THE Browning gun seems to be responsible for much tumult of mind at the present moment and the independent perpetration by many persons of a fairly obvious pun, which might be worse as puns go. It seems that the shooting world is much concerned regarding the possible effects of the Browning automatic gun as an agent of destruction liable to cause a serious diminution of the limited stock of game existing in this country. The sportsman who is armed with a gun capable of delivering in rapid succession the contents of no less than five cartridges is considered likely to abandon all decency and reserve in presence of the temptation to shoot so long as any game is in sight. When a covey of partridges gets up in front of a shooter armed in the ordinary way his opportunities are limited to the firing of two shots from his double-barrel gun. If he had three barrels he would doubtless fire the third on a great number of occasions when he is at present barred by the limitations of his weapon. We have, in fact, in the new automatic shot guns a reproduction of the Winchester pump gun without the disadvantage of having to acquire the novel form of skill which is involved in operating the pump to effect the reloading.

The Browning automatic gun is very aptly described as the equivalent of a five-barrel gun operated by a single trigger. It is regarded by its supporters as no worse than shooting with two or three guns and the necessary assistants for loading. In point of fact, such a comparison is an inapt one to adopt, in so far that the use of a pair of guns and a loader is limited to those whose wealth and social position gives them access to preserves heavily stocked with game and shot over but three or so times in the season. The automatic gun undoubtedly gives to the poor man shooting over sparsely-provided ground a power of destruction which is at present the exclusive privilege of a different class of sportsman altogether. It has been argued that a practical limit is placed on the number of shots which can be fired from a single gun by the heating effect on the barrel. This, however, appears to be a somewhat far-fetched and inapplicable argument. The automatic gun is clearly no rival to a pair of guns when the shooting is conducted in bursts of activity lasting for several minutes at a time. Its special feature consists in the fact that it can fire five shots with great rapidity, and this fairly represents the maximum period during which a burst of shooting can last on ground that is not highly preserved and where driving is not pursued. The destructiveness of an automatic gun must therefore be considered mainly in relation to the sudden flushing of a covey of partridges, or a party of duck or similar wildfowl surprised in the act of feeding.

Another aspect of the same question refers to the relative amount of destruction that would arise in the case of firing into a flock of birds passing overhead. The "browning" of a flock of duck with five cartridges might certainly prove of decided assistance to the day's bag, but were such a practice to become general, birds would either become less numerous or else they would require to adopt a greater degree of wariness in fulfilment of the law of survival. Another factor in which the ability to fire a succession of shots would operate against a sufficient preservation of the breeding stock concerns the increasing distances at which shots might be taken. The shooter who is armed with a double-barrel gun finds no difficulty after a little practice in deciding whether or not a given shot can be taken within a fair sporting distance. Considering the distances at which shooters claim to be in the regular habit of bringing down game, one is entitled to assume that the shooter is as a rule prone to over-estimate the range of his quarry by a very liberal margin. Therefore in using a double-barrel gun the first shot may generally be regarded as being taken at a fair sporting distance, and the second shot follows so soon after as to represent a quite moderate increase of the range.

But it is certain that when once a gun has been aligned on an object it is very difficult to form a really clear conception of the rate at which it is moving away, and the distance it has moved in a given period. The limitations of a double-barrel gun automatically put a stop to peppering the game after it is out of range. Using two guns and a loader, the delay between the second and the third shots is still sufficient to check a shooter who might feel inclined to fire a third time at a bird or animal which has already received two salutes. When the removal of the gun from the shoulder ceases to form a necessary item in the process of firing a third shot there is always the danger that it may be taken at an unsportsmanlike distance. Speaking of the Browning gun purely from a sporting standpoint, we feel inclined to say that a well-trained shooter, endowed with the instincts which we all aim at possessing, would soon learn to control himself in the use of the new gun, so that he might take legitimate advantage of the additional facility it possesses, while avoiding those excesses which are so easily committed with every kind of gun.

The extermination of hares in many parts of the country under the working of the Ground Game Act, and the selfish excesses of which the shooting "bounder" is known to be guilty, make the automatic gun a possible source of mischief; and in the best interests of sport we feel that this aspect of the question cannot entirely be ignored. It would, nevertheless, be a very unfortunate matter if the gun trade became in any way prominently connected with an agitation having for its purpose the prohibition of multi-shot weapons. The cause would undoubtedly suffer from the allegation of interested motives which could not fail to be brought forward. The gun trade as an industry would still be badly hit if a perfect automatic shot gun were produced with accommodation for two cartridges only. The ordinary double-barrel gun is the result of centuries of slow evolution, and a quite appreciable proportion of our population derives its livelihood from the manufacture of this weapon. If its place were taken by the output of a machine-equipped factory a serious state of affairs would result. This is a pessimistic extreme but it certainly illustrates an aspect of the question worthy of attention. In our own opinion the double-barrel gun will hold its own for an indefinite period, and our gunmakers can afford to adopt a philosophic, but nevertheless alert, attitude towards the new-comer. Every shooting tenant is enjoined to utilise his rights in a sporting fashion, and if the new type of gun is introduced it might provide the means for departing from this undertaking. The matter is one which lies well within the scope of the Field Sports Protection

Association, whose sole function it is to carry out the self-appointed task of safeguarding our sporting rights.

Two gunmakers at least have brought out three-barrel guns for the sole purpose of giving the shooter an extra shot at a covey of birds or at bolting rabbits. These guns have been favourably noticed by our leading sporting journals, and their makers have not been held up to opprobrium for producing a devilish contrivance calculated to exterminate the head of game. If the charges alleged against the new automatic gun are found by sportsmen of undoubted independence to be sound, then action of some sort should be taken; and if future legislation enacts that two shots is the maximum that any scatter-gun shall be able to discharge without reloading, the manufacturers of automatic and pump guns must either withdraw their arms from the market, or modify the mechanism so as to comply with the new conditions. If such a consummation were to take place it would not of course follow that the automatic gun had been killed. It is possible that the whole world may be using automatic fire arms in fifty years time, and the gunmaker will belie his past reputation and that of his forefathers if he fails to adapt himself to any new conditions that may arise. His own individuality and skill have hitherto enabled him to compete with the cast-iron models which issue from a factory. The gunmaker must not run too great a risk of emulating the heroic deed of the lady in fiction who endeavoured to stay the oncoming tide with a very inadequate domestic contrivance. The present application of the allegory quoted is that if England restricted the automatic gun, and the rest of the world used it, our rivals might gain a start which could not be recovered when the mistake had become apparent. The electric light industry and the manufacture of motor carriages present well-known instances of legislative interference hampering development of trades which would have prospered from the start had they been free from restrictions. The whole question concerning the use of automatic guns bristles with so many difficulties that we prefer to state the opposing arguments without venturing to point the moral.

MAGAZINE ARMS FOR TARGET PRACTICE.—An interesing feature in the development of the miniature target rifle is concerned with the growing acceptance of the single-shot mechanism as distinguished from rifles which load from a magazine. The magazine repeater is essentially an American device, and its justification is that it forms a convenient means of carrying the supply of cartridges required for immediate use. Through all these years in spite of the success of the magazine arm as a sporting weapon, it has not proved successful in target competitions. It is in fact the general experience that magazine arms as a class, excluding of course those firing hard jacketed bullets, have not shone as weapons of extreme accuracy. Apart from the question of accessibility of barrel for cleaning purposes the main explanation for what has been noticed seems to be that the lead bullet is liable to be deformed and disturbed during the rough handling it necessarily receives in the act of being pushed into the chamber. When we hear proposals to the effect that cadet rifles firing ·22 L.R. ammunition should carry a magazine we feel inclined to think that accuracy would suffer far more than could be balanced by the possible gain in ease of manipulation.

THE NEW GERMAN BULLET.

A SHORT paragraph under the heading of Military Intelligence in the *Times* of the 23rd ult. has apparently not yet received the attention it deserves. It is, in fact, the way with revolutionary changes that their first mention should be given in terms affording but a very inadequate impression of the full measure of their importance. The note in question seems to contain the first English reference to a startling development in military small-arms cartridges. Ever since the success of the modern military small-bore was assured it has been a frequent subject for speculation to decide its possible limits of development. The reduction of diameter in the bullet was accompanied by no material increase of length. In fact, this was slightly reduced, if we adopt the ·303 and the Martini as a basis for comparison. The density was, however, somewhat increased by reason of the reduced amount of slope on the bullet shoulder. Apart from these unimportant differences it was at once obvious from the commencement that the new type of military rifle owed its distinctiveness of character to the use of a bullet of about half the former weight, whose loss of efficiency in this respect was counterbalanced by an enhanced velocity. The altered relation of bore and length necessitated a sharper twist in the rifling, and this in turn required a hard metal covering on the bullet to resist the great torsional strains.

Writers who generalised on the theory of the new departure of twenty years ago assumed from the success which attended this remarkable change of diameter that a further reduction would take place when the time should be ripe for fresh developments. Too much theory and too little practice apparently entered into such speculations. In the 6½ mm. rifle (·256 in.) we have an excellent object lesson, showing the influence of carrying the reduction somewhat beyond the amount recognised as desirable by such nations as Germany, France, Russia, Austria, United States, and our own country. The Spanish model of the Mauser rifle occupies an intermediate position. Experience in sport as well as in war has shown that, while the 6½ mm. rifle is a beautiful weapon of precision, the stopping requirements of a military arm are not sufficiently met when the calibre is reduced much below ·300-bore. The experience of the American Navy also showed that practical conditions put a limit on the possible extent to which the calibre may be reduced. They brought out a 6 mm. rifle, viz., ·236 in. calibre, having a suitably proportioned cartridge and twist of rifling. They found it impossible to reproduce in practice the calculated behaviour of the combination. They shortened the bullet, and then found that the rifle had been degraded into a toy. The navy was accordingly re-armed with the military calibre of rifle. Although the 6½ mm. arm with its ·256 in. calibre barrel is a practical weapon, there has been no tendency to abandon the ·300-bore in favour of the smaller size. There is, in fact, an ever-increasing tendency to regard the larger calibre as most satisfactory for military use on all-round considerations.

The *Times* note, already referred to, is based on a description, which is given in the November issue of the *Kriegstechnische Zeitschrift*, relating in the main to the new pattern of German small-arms ammunition. It appears that the new bullet is pointed in shape, being, therefore known as the S bullet, from the German word "Spitze."

Practical limitations of chamber pressure no doubt mainly account for the reduced weight of the bullet, which provides the means of attaining a greatly enhanced velocity. Although recoil is not mentioned, it is clear that any material increase in the ballistics, unaccompanied by a reduced weight of bullet, would soon outreach the possible limits of recoil. Turning to actual values, we find that the new bullet weighs 10 grammes, which is equivalent to a fraction over 154 grains. This compares with 227 grains for the old pattern bullet, as used in the '88 and '98 models of the German rifle, and 215 grains for the English service bullet. The velocity of the new cartridge is given as 860 metres per second at 25 metres from the muzzle. This value may be regarded as the equivalent for the English observed velocity over 120 feet. It thus becomes 2,822 f.s. velocity, as compared with 2,034 f.s. for the old German rifle and 2,000 f.s. for the English service rifle.

The trajectory values as quoted in the *Times* are rendered doubtful by the presence of obvious misprints. We have, however, had an opportunity of examining the original article in the German paper referred to. In it we can find no reference to the shooting at 4,000 metres, although the *Times* quotes the article as affirming this to be the range of the new bullet when using an angle of 31 deg., as compared with 32 deg. for the old conditions of cartridge. It may be that our contemporary possesses sources of information outside the printed matter which it quotes. At any rate, we have in the above statement the assertion that a 154-grain bullet with an observed velocity of 2,822 f.s. has a flatter course than a 227-grain bullet with an observed velocity of 2,034 f.s. over every part of the possible range of the weapon. The other *Times* figures are mainly concerned with the angles of descent; but as the printer appears in one or two instances to have muddled up degree marks and zeros, the result is more humorous than instructive.

However, from particulars which we have been able to obtain from an independent source there can be no doubt as to the definiteness of the claim that the new bullet equals the old in respect to trajectory at extreme distances, and is superior in velocity over the usual military ranges. We have not up to date been able to make any comprehensive translation of the trajectory tables that lie before us, but picking out at random the angle of elevation necessary for hitting a mark at 1,000 metres distance, we find it is given at something between 0 deg. 50 min. and 0 deg. 60 min. of angle. The above distance represents 1,093 yards, which may be regarded for practical purposes as the equivalent of 1,100 yards, the greatest distance at which target shooting is commonly conducted in this country. The accepted angle for the ·303 service rifle, using service ammunition, is about 1 deg. 43 min. With Palma ammunition this becomes 1 deg. 21 min., which is very nearly the same as the corresponding value for the 6½ mm. Mannlicher. Again adopting 1,100 yards as the equivalent for 1,000 metres, 2·7 sec. of time is the accepted duration of flight for an ordinary ·303 bullet covering this distance. The German result is given as within a minute fraction of 2 sec.

While we frankly accept the new figures as coming from a responsible quarter, we cannot of course endorse any of the values until we are in a position to speak from first-hand information. In a sense they seem to have accomplished so much as to leave on the mind an unpleasant impression that something hitherto regarded as of paramount importance has been sacrificed. The results cannot be criticised from the standpoint of our existing experience with the service bullet, because we have as yet nothing to show us how far they may be influenced by the peculiar shape of the new bullet. One of these which has been submitted for our inspection bears an extraordinary resemblance in shape to the 150-grain short-range practice bullet which was made for target practice some years ago. It was, however, very soon withdrawn from service use, because it was found incapable of giving accurate results. The new German bullet differs only from its prototype as above in having a still sharper point—as sharp, in fact, as the writing tip of an ordinary lead pencil. On general principles the effect of reducing the weight of a bullet and increasing its velocity is simple enough. The high velocity flattens the trajectory. Conversely the lighter bullet loses its velocity at a greater proportional rate.

BALL AND SHOT GUNS.

THE columns of our contemporary the *Field* have lately contained an interesting discussion conducted respectively by the firms of Holland & Holland and Westley Richards, concerning the advantages, probable and improbable, of sighting the above weapons for a range of 300 yards. Granting the possibility of obtaining reasonably close groups at the above mentioned distance it is still a moot point whether the conditions of the bullet's flight do not entirely counteract the possibilities of using the weapon at such a distance. Accuracy over measured distances is known by the practical sportsman to be a meaningless phrase unless it carries with it the possibility of repeating much the same results over unknown distances. The tendency of late years has been to develop sporting rifles in the direction of extreme velocity and flatness of trajectory, whereby the penalty for range mis-estimations is reduced to the smallest possible extent. This being the practical verdict of the sportsman it must be acknowledged that there is much in favour of the view that a bullet, which is essentially limited to a low initial velocity and a trajectory having a fullness of curve out of all proportion to the weight of the projectile, is the weapon least suited of all others for long distance shooting. The modern sportsman enjoys such a marvellous selection of high velocity rifles with considerable striking power at all sporting distances as to make it appear strange that anyone should advocate the use at 300 yards of a weapon whose characteristics repeat the conditions of 50 years ago. The ball and shot gun within its own particular field is so marvellously effective as to make it seem a pity to put forward on its behalf claims which practical experience cannot substantiate. More than this the recent improvements of bullets have done so much to enhance the efficiency of the rifle at distances slightly beyond those at which it was previously desirable to use it as to make it unfortunate that the claims of enhanced excellence should have been carried to a length which arouses the opposition of many users and advocates of a most valuable form of sporting weapon.

A GERMAN "ARMS AND EXPLOSIVES."—A leaflet has been issued announcing the publication in January next of Volume I., No. 1, of *Die Zeitschrift für das Gesamte Schiess-und Sprengstoffwesen.*

CONTINENTAL DOINGS.

KEENLY CONTESTED RIFLE MATCH.—In all the cities and large towns of Belgium a special battalion of *Chasseurs à pied* forms part of the Garde Civique, which is something between our regular and volunteer force. The late Captain Fischer founded an Ecole de Tir, or shooting practice society, for the Liége Chasseurs, offering as a prize a facsimile of the Wimbledon Cup, which is competed for yearly at the International Rifle Contest, Brussels. This year's match, lately shot off at the Liége Municipal Range of 300 metres (328 yards) was won by *M.* Bury with 165 points, the second making 163; and the 30 competitors put all their shots into the target, notwithstanding the bad weather. Each man fired 33 shots, 11 each in the three positions of standing, kneeling and prone, the first three for trial and the remaining eight counting as score.

REMOVING THE FUMES DUE TO GUN DISCHARGE.—In casemates and armoured cupolas, when only a few shots per minute are fired, very little smoke is produced; but with modern quick-firing guns the atmosphere soon becomes unendurable by reason of the smoke entering at the embrasure and the gas given off from the breech when opened for loading. The authorities of the Belgian Engineer Corps have found the necessity for artificial ventilation, and have carried out trials with reaction fans made and exhibited at Liége by M. E. Farcot, Plaine Saint-Denis, Paris. Driven by electromotor or oil engine, or simply turned by a couple of men, these fans set up an over-pressure of 10 or 15 per cent., which effectually prevents the re-entrance of smoke, while the compressed air escaping carries off the fumes.

GREAT ACTIVITY AT THE KRUPP WORKS.—Never from the foundation of these immense works have orders for artillery poured in so freely as since peace was concluded between Russia and Japan. Though the number of hands has been increased to 55,816, it is necessary to work overtime, while there is a question of putting up new cannon shops and foundries. The works, which were owned exclusively by the late Friedrich Alfred Krupp, were left by him to his eldest daughter, who holds all the shares, representing one hundred and sixty million marks (£8,000,000), in the company formed at the express wish of the testator. The management is entrusted to a "Direktorium" of twelve members.

MINE BLASTING.—This is one of the subjects that has been greatly enlarged upon in the first volume (just published by Dunod, Paris) of the third edition of Haton de la Goupillière's Treatise on Mine Working, supplemented by *M.* Bès de Berc, Ingénieur au Corps des Mines. The study of explosives, the methods of their use and preservation, and the demonstration of the new theories relating to their chemical composition have been dealt with at considerable length (observes Prof. Couriot) as also the mechanical drilling of shot-holes.

FRENCH OR GERMAN FIELD PIECES FOR BELGIUM.—With reference to last month's note on this subject, the statement of a French paper, that the Saint-Chamond guns have been preferred to those of the Krupp Co., is manifestly incorrect, because the report by Generals Heinburger and Pioch, Major Lechar and the Brasschaet Experiments Commission is not to be sent in to the War Department before December. This contradiction is by the *Meuse*, which asserts that both pieces have given every satisfaction as regards firing, but that the Krupp has shown better results in travelling.

NECESSITY FOR EMPLOYING A SUFFICIENT DETONATOR.—For detonating explosives in mine workings Herr Bichel advises that a quantity of fulminate rather larger than that strictly necessary be employed, in order to avoid the possibility of incomplete explosions. In fact, if dampness should penetrate into the fulminate capsule, or if the latter should be displaced in the cartridge, the explosion may only be partial. In such a case the explosion may not be communicated to neighbouring cartridges. Accordingly, not only should a sufficiently large charge of fulminate be employed, but the explosive must be capable of communicating the explosion to other cartridges, even if the space separating them be a few centimetres (one centimetre = 0·394 in.) between that provided with the detonator and the one next to it.

HOW ARE HIGH EXPLOSIVES DETONATED?—As a reply to this question Herr Bichel's experiments have shown that the shock necessary to cause an explosion varies considerably with the nature of the explosive and that, the greater the shock required, the greater also must be the charge of mercury fulminate. In endeavouring to determine the detonation speed of the fulminate, he has found 3,920 metres (12,850 ft.) per second, for a diameter of 6·45 mm. (¼ in.); and, as the usual diameter of the cartridges for high explosives is 30 mm. (1·2 in.), it may be admitted that the detonation speed of mercury fulminate is much greater than that of high explosives. Heat alone merely exerts a secondary influence as regards the firing of explosives; but, as the detonation temperature of mercury fulminate is 4,382 deg. centigrade, it may be admitted that the fulminate acts chiefly by the great speed of its detonation and also, though subsidiarily, by the high temperature it produces.

NEW CLASSIFICATION OF EXPLOSIVES.—In a paper before the Liége Mining Congress, Herr Bichel, Director of the Sprengstoff Actien Gesellschaft Carbonit, Hamburg, classifies explosive substances according to their liability to be detonated by shock. He used for his experiments small drop hammers, the blocks of which are raised in a graduated tube, being allowed to fall from the height desired, the various high explosives being prevented from moving laterally on receiving the impact. The following is the order thus obtained:—

1. Pure nitroglycerine, which regularly exploded on receiving the impact of 100 grammes (3½ oz.) falling from a height of 15 cm. (6 in.).
2. Nitroglycerine and its derivatives.
3. Explosives composed of nitroglycerine and ammonium sulphate, such as gelatine-carbonite.
4. Kohlen-carbonite and other explosives with slight nitroglycerine contents.*

5A. Ammonium sulphate explosives with a slight quantity of nitroglycerine, such as ammon-carbonite and donarite.

5B. Explosives composed entirely of ammonium sulphate, such as Grisoutite-Couche and Roburite II.*

6. Trinitrotoluol, which is the most insensible to shock, picric acids and guncotton.

The practical use of these comparative experiments is to show that the strength of the detonator must be in inverse proportion to the sensibility of the explosive to shock.

* Weights of 20 kilogrammes (44 lb.) falling through 5 cm. (2 in.) invariably caused explosion.

ROUND THE TRADE.

We understand that a new circular regarding the stability tests for explosives is at present in course of preparation by H.M. Inspector of Explosives.

The *Financial Times* states that the directors of the Rexer Arms Co., Ld., have declared an interim dividend of one shilling per ordinary share for the six months ended the 31st October last, this being at the rate of 10 per cent. per annum.

Col. H. C. L. Holden, R.A., gave some interesting particulars to the Institution of Electrical Engineers at their annual meeting concerning the various up-to-date methods which are employed in the Royal gun factory for increasing output and raising its quality. He naturally laid special emphasis on the electrical appliances used.

The B.S.A. Company installed a well-equipped miniature rifle range at one of the minor halls of the recent cycle show, the object being to introduce the new air-gun to the large number of visitors to the show. The outlay involved produced a very successful advertisement, in so far that the eleven targets were fully occupied during the entire period of the show.

In connection with an article which appears elsewhere in this issue, it may be mentioned that a French journal lately referred to the new solid bronze bullet which has a hollow base and a nose tapering to a fine point. The whole question concerning the new class of bullet is of course the as yet unsolved problem as to the exact value of the factor for air resistance.

By the death of Mr. W. H. Greenwood the Birmingham Metal and Munitions Company have lost a highly capable manager and technical expert on metallurgy. There are few men in commerce who combine, in the manner that Mr. Greenwood did, a thorough knowledge of the scientific aspects of a subject and a practical acquaintance with the purely manufacturing side of the work.

The firm of Beardmore have lately applied in Glasgow for the usual permit to erect a gun factory on a piece of unoccupied land adjoining their present works. The particulars which have been lodged in this connection show that it is their intention to manufacture large naval guns on a considerable scale, such as 12 in., 9·2 in. and 7½ in. calibre. Up to date the only manufacturers in this country of guns of this size are the firms of Armstrong and Vickers-Maxim.

We have been informed that the Proof House authorities are busily engaged preparing a comprehensive circular showing the whole of the foreign proof marks which are at present recognised in this country as having the same authority as the English marks. The existing particulars on this subject are sadly out of date, but the preparation of a new leaflet has been delayed for some time past by the difficulties of obtaining proper authentication of every mark which it is proposed to quote.

A correspondent has written to us in connection with our article last month on rifle ranges, pointing out that the apparatus which won the prize in the competition at Bisley, 1904, between various forms of open-air installations was worked by a single overhead wire, and not by means of the double pair of rails as described by us. The mistake was easy to make, since the report embodying the Committee's award gives no description or general particulars of the winning or any other apparatus.

A double-sheet notice dated the 1st March last has lately reached us, being issued by Monsieur H. Mahillon, of 9, Rue de Loxum, Brussels, and Mr. F. C. Scott, of 80 and 81, Bath Street, Birmingham, jointly. Monsieur Mahillon gives notice that he has relinquished the agency of the Webley & Scott Arms Company in Birmingham to take over the representation of Mr. F. C. Scott as above. Mr. Scott confirms the appointment of *M.* Mahillon as his agent in Belgium, and states that a selection of guns has been dispatched to his address.

Messrs. L. Le Personne and Company have sent us a notice to the effect that as sole agents for the United Kingdom and the Colonies to Messrs. Auguste Francotte & Co., of Liège, they have made an arrangement with Messrs. Martin Pulvermann & Co. granting them a monopoly for the sale to home trade buyers of the well-known Martini-Francotte and Martini-Henri rifles of various patterns as made by the above firm in their factory at Liège. Home trade orders should in future be sent to Messrs. Pulvermann, whereas export business should be conducted as heretofore with Messrs. Le Personne.

In the report of the directors of the De Beers Consolidated Mines, Ld., a good deal of attention is naturally devoted to the Company's explosive factory at Somerset West. In accordance with predictions made last year the output for the year ending June 30th last, has been materially increased, a total production of 175,281 cases having been attained. This is by no means regarded as high-water mark. The capital expenditure on the factory, as shown in the balance sheet, represents £750,000, but the actual outlay, including £282,000 for stores on hand, reaches a total of £1,308,263. At the annual meeting of the Company it was announced that the directors had resolved to form a separate company to run the explosives factory.

Capt. Desborough's report on the explosion of magazine at the Thames Storage Company's factory at St. Mary's Marshes, Kent, has just been issued. It appears that the magazine was noticed to be on fire, and that the conflagration continued until the entire building and its contents had been destroyed. After carefully reviewing the various explosives stored in the magazine and their position with reference to the place where the fire first broke out, Capt. Desborough gives the following summary of his conclusions as to the most probable cause of the accident :—"(1) The fire was probably originated by the spontaneous decomposition of one of the explosives stored in the magazine. (2) Most probably the rifle powder spontaneously decomposed, but in the absence of direct evidence to this effect a certain amount of suspicion must be attached to the Walsrode powder stored in the south-west corner of the building." It may be mentioned that the Walsrode powder in question had been under storage for a period of nine years. The two points which seem to be made plain by the accident and its consequences are :—"(1) The necessity for carefully watching and from time to time examining all explosives which have been stored for any considerable length of time, and (2) The desirability of not allowing the grass on the mounds and in the immediate vicinity of magazines to grow too long." The latter precaution is designed to prevent the communication of fire from one building to another.

At Clerkenwell on the 3rd and 18th ult. Messrs. A. W. Gamage, Ld., appeared before Mr. d'Eyncourt to answer summonses taken out at the instance of the Gunmakers' Company in reference to the selling and keeping for sale of sundry unproved walking-stick guns to the total number of 54. At the first hearing the defendants admitted the offence, and pointed out that the weapons had inadvertently escaped notice. The prosecution alleged that the public particularly needed protection in reference to guns of this class. The question of costs and penalties was reserved until 55 of the guns complained of had been tested, and the result communicated to the Court. At the second hearing it was duly shown in evidence that four of the guns had been blown to pieces, and that fifty of them had stood the test, as did the single gun which was originally purchased by the prosecution. The defendants pleaded that the fact of four guns having failed to stand the proof should not prejudice their case in the eyes of the Court, the offence complained of being that of selling or keeping for sale unproved guns, a matter which should not be complicated by the ability or otherwise of the guns to stand the proof. It was also urged that the number of guns which had failed under a proof, which was in the nature of things a severe one, did not in any way imply that the public would have been exposed to danger when using the ordinary service charges. The magistrate imposed a fine of £3 on each gun, amounting to £165 in all, £75 of which would be paid to the Gunmakers' Company to cover their costs.

BURST GUNS.

EACH shooting season inevitably brings to light a certain number of highly regrettable examples of guns bursting in use. While there is no direct means of obtaining anything in the nature of comprehensive statistics the instances which come to notice in various ways afford an approximate means of establishing a comparison. Signs are not wanting that the number of accidents this year have been somewhat in excess of the normal, and it may be worth while to consider the general circumstances surrounding those cases which have been subjected to careful enquiry. In the first place the bursts which have occurred appear to have been of a particularly destructive character, in that the injury has taken place at the portion of the barrel which lies above the fore-end; that is to say where the left hand of the shooter grasps the gun in the act of firing. Such bursts are mostly characterised by the blowing out of a flap of metal. The longitudinal tear takes place along the corner formed by the rib, where the barrels are liable to be rather thinner than at other parts of the circumference. An additional reason why the first fracture of metal should take place near the rib is concerned with the mechanical law that a piece of metal is the weakest in the corner formed by a projecting flange. This does not imply actual weakness of the fibre, but merely that the place where the ordinary elastic give and take is checked receives a special amount of strain.

Reverting to the specific case of a burst double-barrel gun, the longitudinal fracture is followed by a circumferential break at either end, so that a portion of the barrel is blown open in the manner of a trap-door. The fracture adjoining the rib provides a means for the gas to escape in the space lying between the two barrels and underneath the top rib. As a rule the rib separates from the barrel over the greater part of its length, the lower rib oftentimes behaving in a similar fashion, so that the barrels come apart. When a trap-door burst takes place at a point a few inches in front of the chamber the only possible explanation in nineteen cases out of twenty is the presence in the barrel of a weighty obstruction. This obstruction can seldom consist of foreign matter introduced into the barrel by way of the muzzle. Mud and snow, possessing the needful density of material, are obviously confined to the muzzle end of the gun. A loose obstruction, such as a stone, capable of falling down the barrel, provides a very unlikely explanation of serious accidents. In the first place it would probably lie on the top of the cartridge, where it would be capable of doing very little harm. In fact, it is almost impossible to conceive circumstances under which an obstruction capable of passing from the muzzle to the breech could lodge in the barrel at any point forward of the chamber.

The possible obstruction is accordingly limited to something entering the barrel from the breech end. This may either consist of the tube of a cartridge case which has parted near the head, or else an entire charge of shot. It is very doubtful whether a detached cartridge tube could get beyond the chamber. Supposing this to happen, the tube would hardly possess sufficient resistance to cause a burst. If on the other hand the charge of shot carried the tube along with it, it seems impossible to realise under what circumstances the combination could fail to be ejected from the muzzle. In fact, if a tube did pass forward with its charge of shot, the probable result would be a considerable increase of chamber pressure and an escape of gas from the breech. Of these occurrences the shooter would be well aware; but the cartridge tube with its attached charge of shot would probably pass out of the muzzle by reason of the momentum it had acquired before the escape of gas had taken place. We are thus limited in practice to regarding a non-expelled charge of shot as the chief cause of bursts in front of the chamber. Mr. Griffith has conducted experiments showing just how much Schultze powder is required, in addition to the explosive force of the cap, to push a charge of shot out of the cartridge, while leaving it in the barrel. Such experiments are of considerable use; but the results must of course be influenced by the boring of the gun. The whole question seems to resolve itself into one of taking every possible precaution by way of automatic warning apparatus to show when a cartridge case has missed, wholly or in part, the powdering process. Cartridge loaders should bear in mind the advisability of insuring visible evidence that each cartridge receives its full quota of powder.

Capt. Lloyd has issued his report concerning the nitroglycerine explosion which occurred in the fitters' shop of the factory of the Explosives and Chemical Products, Ld., at Bramble Island, Essex. "The factory," writes Capt. Lloyd, "is on Bramble Island, which is a piece of reclaimed land lying about five miles south of Harwich, and which is below level of the sea at high water. The factory licence was granted on the 10th April, 1899, to Mr. David Paisley, and was immediately transferred to the High Explosives Company, Ld. This Company found it necessary to reconstruct a considerable portion of the factory before taking it into use. They only worked for a few months in 1901, and after existing for about three years, went into liquidation, and on the 10th January, 1903, the factory was transferred to Mr. W. H. Fox, who had been appointed receiver for the Company. A new Company was formed in 1904 to take over the factory under the name of the Standard Explosives Company, and work was carried on by them until the early part of this year, when the factory was sold to the present occupiers, who are a Sub-Company of a very large French Company, under whose control it may be hoped that the factory will have a less chequered career." One man was killed whilst occupied in removing some old gauzes from a set of sieves with a view to fixing new ones. The sieves had apparently been thoroughly cleansed, but the heat of the soldering process caused an explosion of some nitroglycerine which had remained in a tube. The fact that nitroglycerine had collected in a hollow tube forming a portion of the framework of the sieve and had afterwards exploded, is regarded as involving no question of blameworthy action on the part of the deceased or the manager who ordered the work to be done. The error of judgment which led to the accident rests with the person who originally designed the frame of the sieve on defective lines. Capt. Lloyd concludes by giving a few useful hints on the designing of explosive apparatus with a view to the avoidance of cavities and other places where explosive material may lodge and prove a source of danger in the event of repair operations being required.

SOME PROBLEMS IN INTERNAL BALLISTICS.

IT is so seldom that an English officer gives us any material of scientific interest to the gun student, that an article by Lieut. H. J. Jones, Inspector of Ordnance Machinery and of the Army Ordnance Department, appearing in the *Journal of the Royal Artillery*, comes as a welcome change. Lieut. Jones takes for the subject of his essay the title which we have ventured to appropriate for our all too brief review of his interesting remarks. He commences by treating the gun as a heat engine. Although the analogy is singularly complete in many aspects, he points out that with a gun the calculations are not nearly so simple as in the case of the gas or steam engine, for, when we have settled the nature and weight of the propellant, the proportions and weight of the projectile, the nature, shape and number of rifling grooves, &c., our story is done ; and since the wear and condition of the gun ; the temperature and condition of the propellant ; the temperature and humidity of the air; the barometric pressure; the wind, and the nature of the mounting, all prejudice the accuracy of shooting, and enter as important and more or less uncontrollable disturbing factors, it follows that the uncertainty to which they give rise must add an additional complexity to the already complex problem of finding a satisfactory solution to the ballistic problem with which we are concerned.

In speaking of the intimate dependency of the rate of burning of an explosive charge on the pressure under which the chemical change takes place, Lieut. Jones points to the circumstance that nearly all modern theories of the mode of explosion of homogeneous structureless bodies, such as cordite, proceed on the assumption of burning by concentric layers. Although this may be true for any one stick, a little consideration will show that the application of this fact in the usual way is highly incorrect. It is generally assumed that if there are 'n' sticks in a charge the total weight of charge burnt in a given time is 'n' times that which would be burnt from a single stick, in the same time, under the same conditions of pressure. This is equivalent to saying, that if during any time the reduction in diameter of any stick is one-thousandth of an inch, the reduction in diameter of every stick in the change is one-thousandth of an inch. But it is obvious that when bundles of sticks are burning the surface sticks must necessarily behave differently as regards thickness of skin burnt per second, to the central sticks.

Then, again, with regard to the temperature which is attained when using cordite, microscopic examination of the bore reveals actual fusion of the metal near the rear end of the rifling, and pieces of platinum and platinum-iridium have been fused when placed in explosion vessels. But as in the case of internal combustion engines, calculated temperatures are as a rule much higher than those actually found or inferred from the above indications. And the explanation is not far to seek. For all the calculations are based upon the nature of the products after they have cooled to the temperature of the atmosphere, and it is assumed that the products under these circumstances are identical with those existing at the high temperatures, whereas it is probable that at the high temperatures the heat may be sufficient to determine much simpler products, and to cause a marked alteration in the physical properties of the gases.

The peculiar difficulty of pressure determination under the circumstances obtaining in a gun is that we are dealing with something which, although we can recognise and approximately measure its effects, yet has no physical existence in relation to the whole mass of our explosive, and we are hence not permitted to frame any satisfactory conception answering to the phraseology which we use. We can be fairly certain that in passing from the rear end of the chamber, where the gases are comparatively at rest, to the base of the projectile, where they are moving with high velocity, considerable differences of pressure must exist. In the above manner Lieut. Jones expresses in a carefully thought out manner the difficulties of measurement which are peculiar to pressure taking in guns, and more than that, the special sense in which any measured pressure must be interpreted.

In speaking of the crusher gauge as a dynamical instrument, the author has a particularly happy way of expressing his meaning. It has, he says, long been argued that the general consistency of the crusher gauge, and the simplicity of its apparent action are strong points in its favour, but examination will show that the action appears simple, because its complexities are not obvious. Were it not for the obscurity of certain facts, the action of a crusher gauge would by no means appear simple. When we consider the effect of the time rate of application of pressure, and of the total time interval of exposure to pressure, we shall find the matter to be complex in the highest degree.

The circumstance which gives rise to the great source of uncertainty when intepreting a crusher gauge record, is that we have no means of comparing dynamic pressure—the pressure arising from shock—with static pressure—the pressure of steady application ; and that the elastic properties of metals under dynamic and momentary stresses are quite distinct from those of the same metals under dead loads. The only certain measure of shock pressure is the time rate of destruction of momentum, and unless we work with a time rate in place of the usual space rate, our conclusions cannot help but be misleading.

The element of time enters the problem of pressure determination in two quite different ways. In the first place we are concerned with the time rate of application of the load, or with the time interval between the load coming on, and the maximum load being reached. And, secondly, we are concerned with the total time during which the load is carried, or with the interval between the load coming on and being finally removed. The second interval includes the first, but its effect is quite distinct, and although the first interval is of very small magnitude, it derives relative importance from the fact that as we attain to higher pressures and higher average velocities, the total time of exposure becomes reduced to a magnitude comparable with the time of application.

At the moment when the crusher gauge is exposed to pressure the gases may be moving with considerable velocity, particularly if the gauge is in the chase of the gun. The load suddenly applied to the piston, is that due to the destruction of the momentum of such mass of gas as is diverted and impinges on it. The pressure at any instant, in fact, is a numerical measure of the time rate of the destruction of momentum then going on. Now, it is obvious that the

maximum pressure on the piston cannot be attained instantaneously, but only after a short interval of time, and this interval will depend upon the average pressure of the gases at the time of exposure, and in the neighbourhood of the gauge; on the density of the gases; and on the area of the piston; for the mass of gas impinging on the piston is at first that which would escape into the atmosphere if a hole were bored into the gun parallel to the axis of the gauge, and equal in sectional area to that of the piston, and the mass of gas escaping per second from such an orifice under the conditions obtaining in a gun, would depend upon these variables. The momentum of the impinging gases is imparted to the piston and the copper cylinder, with the result that motion takes place, and the copper is compressed, the momentum of the system being destroyed partly by the molecular friction of the crushed copper, and partly by the friction of the piston and gas check. The measured compression of the copper cylinder thus gives us a space rate of destruction of momentum, which, however, does not, and can not, afford us either a measure of the pressure variations during the charge, or of the maximum pressure reached. It is here that lies the peculiar fallacy of all dynamic measures of force by reference to space or energy relationships.

With regard to the second time interval, we have to notice that the copper cylinders are exposed to pressure for very short and very unequal times. A gauge in the chamber is under pressure for the whole of the period of motion of the projectile, while one near the muzzle is under pressure only for such a period as elapses between the projectile passing it and finally leaving the gun. Now since the compression of a metal which has passed the elastic limit, and received a permanent set, depends not only on the pressure, but also on the time of exposure to pressure, it follows that crusher gauges from different parts of the same gun will not admit of direct or simple comparison. When the gauge is placed in front of the base of the projectile the piston is not acted upon by the gas pressure until the instant that the base passes it. The pressure of the gas at this instant represents the initial value of the load applied to the piston, and its movement is quite different from what it would have been had the initial load been zero. Thus we get a perfectly rational explanation of the supposed abnormal pressures registered by gauges placed on front of the initial position of the projectile, as compared with those registered by gauges in the chamber.

From various considerations, of which a few have been stated above in the form of extracts, the author puts forward the following conclusions as evident that:

1. The pressure on the base of the projectile may be 10 per cent. lower than that registered in the chamber, and hence the gases cannot be considered to be at anything like uniform pressure.

2. That with ordinary Service gauges an appreciable error is introduced, owing to the rapid rate of development, and the rapid rate of application, of pressure. The error increases with the rate, and is most certainly demonstrated when the gauge is a few feet forward of the shot seat. For any gauge it cannot be less than 3,000 to 5,000 lb. per sq. in.

3. That gauges placed anywhere, other than to the rear of the shot seat, are absolutely useless.

4. That when the gauges are so placed they indicate a considerably higher pressure than that which is accelerating the projectile.

5. That, viewed in the most favourable light, the crusher gauge gives an element of uncertainty ranging from 20 to 30 per cent.

It would thus appear that we are still far from having an exact estimate of the pressure arising from explosive action, the main reason being that we are working with a most unsound principle—that any relation exists between the effect of shock and steady pressure, other than a time relation, which we make no effort to determine. The particular point to which attention is drawn is not so much the actual magnitude of the possible experimental error, to which we are liable in using a crusher gauge, as to the uncertainty of the error, and the difficulty of determining, under any particular circumstances, what the error is.

Following the above review of the subject the author has a good deal to say in reference to the heat energy evolved by the combustion of a charge of explosive. This in relation to the amount of pressure registered by the gauge introduces the very important question as to whether the margin of strength considered to exist in the gun truly exists. The treatment of this subject is somewhat too mathematical for us to be able to give a fair rendering of Lieut. Jones's conclusions. In a similar manner readers must be referred to the original text for the various formulæ which provide a means for determining the requisite charge of cordite for a given purpose and the appropriate size of strand to be used. In such a connection it is very unfortunate to find that the miserable rule about confidential information constantly mars the opportunity of publishing interesting data. In such matters as this the question of secrecy can hardly be of practical importance, for the simple reason that the information is not of the kind which can be kept from rival Powers had they the wish to possess it. More than this, so much of what is supposed to be confidential is in reality common knowledge, but it must not be used for the instruction of officers deprived of access to official information, because in some way or another it has been entered on the records of one or other of the departments.

Although the author of these remarks purposely confines himself to treating the more elementary ballistical questions, he still touches upon many subjects which involve highly debatable points of a technical character. Part III. of his paper, which treats of the frictional losses between the projectile and the rifling, undoubtedly falls within this description. The energy wasted in friction and the amount absorbed in imparting rotational velocity to the shot, each represent a material proportion of the total energy output of the gun. The formulæ which compare the loss of energy arising from friction due, in the first place, to a uniform twist of rifling, and in the second, to an increasing spiral will be found of interest even by those who are unable to follow the mathematical reasoning. In treating the question of rifling the author deals with such debatable points as relative movement between the copper band and the shell. He similarly touches upon the influence exercised by the eccentricity of the driving band. He also treats of the influence exercised on dispersion of the shots by the presence of the centre of gravity at a place outside the geometrical axis of the shell. Altogether we find that the author has made excellent use of a happy power of expression to explain in simple language many of the things which are a closed book to those who are insufficiently advanced to approach a subject from the mathematical standpoint.

CORRESPONDENCE.

PROOF HOUSE PROSECUTIONS.

TO THE EDITOR OF *Arms and Explosives.*

DEAR SIR,—It was with interest that I noticed the article in your paper on the subject of "Proof House Prosecutions," and it was gratifying to find that the writer appreciates the fact that we use every reasonable care possible to protect the public by making a careful examination of all guns which pass through our hands for sale by auction. I would draw your attention to a circular headed "Proof of Gun Barrels," which was issued under the signature of the Clerk to the Gunmakers' Company, and also that of Joseph Rowlands, Law Clerk to the Guardians of the Birmingham Proof House. This document calls attention to certain offences and penalties enacted by the Gun Barrel Proof Act, 1868, and refers to sections 122, 108 and 109 in which it makes it an offence to sell, exchange, etc. any gun the barrels of which have not been duly proved and marked as proved.

The document in question in no way refers to the lock of a gun also bearing a proof mark, but on enquiry of the Clerk to the Gunmakers' Company I understand that it is just as important under the Act that the lock should likewise bear the necessary proof mark. For the guidance of those who may buy, sell or exchange guns it seems to me a matter of some importance that the circular issued by the Gunmakers Company and the Birmingham Proof House should give some clear directions as to the proof mark on locks as well as on barrels and perhaps it might be well for you to confer with the Clerk to the Company with a view to this addition being made to the circular which bears his signature.

Yours faithfully,
For DEBENHAM, STORR & SONS, LTD.,
H. M. ALLOM,
Managing Director.

[Assuming that our correspondents refer to the body or action of the gun when speaking of the lock, their difficulty can be met by quoting the following extract from the definition of the word "barrel" as it is given in the Proof Act:—"Barrel includes * * * every Breech of every Small Arm, and every Part of every Small Arm which would in the User of the Small Arm contain all or any Part of the Charge of the Small Arm, and every Part of every Small Arm in, from, or through which Part in the User of the Small Arm all or any Part of the Charge thereof would be exploded or discharged." It would be difficult to imagine a more perfect example of the use of words to conceal meaning. One may, however, assume from the above phraseology that the term "barrel" includes every necessary component of a firearm which is employed in the act of firing it. The rules of proof lay down with sufficient clearness the particular manner of applying the marks to the different parts of the gun.—ED.].

SWORDS IN THE GERMAN ARMY.—There is serious thought of suppressing the officer's sword in German infantry regiments, except for parade, because it is worse than useless in leading a charge, and only affords a mark for the enemy. This was shown in the South African war; and in the China expedition many officers left their swords with the baggage, so as not to be fettered in their movements.

CADET RIFLES.

SIR,—Mr. Mann is certainly on the right track when he calls attention to the many good qualities of the long-rifle cartridge issued by the Peters Cartridge Company. Shooters over here would have long ago made far more use of Peters ammunition had the arrangements for its distribution been better carried out. It may perhaps be news to your readers that these difficulties have now been overcome. The South British Trading Company, whose first-class business methods have done so much of late years to popularise the Stevens rifle, and later those of Savage's make, have taken over the agency for Peters cartridges. I understand that they will stock them in large quantities, and that supplies may even now be obtained from this source. An important merit of the new Peters ammunition, which distinguishes it from that of U.M.C. manufacture, is not only that the bullets are better held to the shell, but they supply their cartridges loaded with semi-smokeless powder. The ·22 short smokeless is an excellent rabbit cartridge on account of the small noise it makes, but many shooters would prefer the long-rifle ammunition but for the disturbance caused by the great noise of discharge. The Peters brand of long-rifle cartridge contains a charge of King's semi-smokeless powder. The noise and smoke are much reduced, making the cartridge more suitable for small game shooting on the one hand and for indoor target shooting on the other. I hope that this brand of ammunition will very shortly be stocked by all gunmakers and cartridge dealers. The semi-smokeless powder keeps its velocity during the winter, while ordinary smokeless deteriorates very badly. MARMADUKE TOPPINGTON.

APPLICATIONS FOR PATENTS.

OCTOBER 23—NOVEMBER 18, 1905.

21,505.* Dynamite. G. P. Horteloup. (Date of application in France, October 24, 1904)
21,528. Gun-Sighting Instruction. J. E. Bray.
21,529. Explosives. M. Abelli.
21,558.* Torpedo Discharging. A. Prodam and A. Keretz.
21,599.* Automatic Arms. W. D Condit and E. H. Searle.
21,619. Cannon. G. M. Swifte-O'Fflahertie.
21,636.* Small-arms. J. M. Demay, B. Ferreol, and J. M. Murigneux. (Date of application in France, September 25, 1904).
21,668. Repeating Firearms. Sir C. H A. F. L Ross
21,700.* Sword Stick. G. W. & S. Davis.
21,779. Smokeless Powders. A. T. Cocking and Kynoch, Ld.
21,825.* Time Fuse. C. P. Watson.
21,857. Projectile Fuses. H. V. Cuthbert-Keeson.
21,929. Ordnance Brake. Rheinische Metallwaren-und-Mf. (Date of application in Germany, October 29, 1904).
21,936. Torpedoes. Sir W. G. Armstrong, Whitworth & Co., Ld., E. W Lloyd, and W. H. Sodeau.
21,967. Ejector Mechanism. W. Baker.
22,018. Small-arm Safety Device. L. Quoilin.
9,379A.* Automatic Pistol. J. Warrant. (Date of application under Patents Rules, 1905, May 4, 1905).
22,058. Firearms. A. Harper and H. Kernaghan.
22,087. Mines. A. A. Stöhr.
22,125.* Explosives. J. de D. Tejada.
22,131.* Small-arms. H. Danner.
22,135.* Locks for Small-arms. M. V. B. Allen. (Date of application in U.S.A., December 16, 1904).
22,136.* Gun-Locking Device. M. V. B. Allen. (Date of application in U.S.A., November 26, 1904).
22,161.* Projectile. E. Liehoff.
22,162.* Projectile Valves. E. Liehoff.
22,202. Air-Gun Locking Device. O. Will. (Date of application in Germany, April 25, 1905).

22,344 Howitzers. Sir W. G. Armstrong, Whitworth & Co., Ld., and Sir A. Noble.
22,348. Projectiles. M. C. Maunsell.
22,409. Barrel Tubes J. Hill.
22,482. Target. W. Reeve.
22,489. Torpedoes. E. Pulsford.
22,550. Air-Guns. L. Jeffries.
22,607. Projectile Fuse F. Beale.
22,658. Sights. C. G. Bonehill.
22,681. Air-Rifle Sights. The Birmingham Small Arms Co., Ld., A. H. M. Driver, and G. Norman.
22,739. Range Finder. J. Formby.
22,795.* Projectiles. Fried. Krupp, Ag. (Date of application in Germany, January 30, 1905).
22,828. Gun Carriage. C. Holmstrom, E. Middleton, and A. E. Mascall.
22,829.* Rifled Tubes. H. H. Lake. (Agent for *L. Lincoln*).
22,844. Ordnance. C. Holmstrom and E. Middleton.
22,891. Targets. J. F. Vaughan and C. G. Bonehill.
22,923.* Small-arms B. Behr.
22 934.* Guns. W. D. Smith.
22,977. Targets. T. B. Ralston.
23,045. Ordnance Mountings A. F. Petch, A. C. Lochenies and R. Redpath.
23,076. Ammunition. T. Brown.
23,137. Cartridge Cases. The Metals Corporation, Ld., and P. Cowper-Coles.
23,160. Small-arm Bolt Mechanism. J. Carter.
23,238. Explosives. F. H. Bennett and J. Maston.
23,244. Rifle Adaptor. A. N. Tucker.
23,324. Cartridge Belt. J. Hyland and F. G. Hughes.
23,371.* Projectile Fuses. Fried. Krupp, Ag. (Date of application in Germany, February 14, 1905).
23,513.* Ordnance Recoil Brake. F. B. Yingling. (Date of application in U.S.A., December 1, 1904).
23,519. Torpedoes. S. Brotherhood and C. W. Bryant.
23,533. Machine Guns. T. R. R. Ashton.
23,601. Ordnance. C. P. E. Schneider.
23,805.* Telemeter. A. M. J. Joors and A. V. J. Mercenier.

* These Applications were accompanied by complete Specifications.

SPECIFICATIONS PUBLISHED.

OCTOBER 26—NOVEMBER 16, 1905.

COMPILED BY HENRY TARRANT.

15,531 (1904) **Sighting Guns from Cover**. W. Youlten, London. Further improvements upon the hyposcope, an instrument through which a gun may be sighted whilst the shooter is under cover, are described in this specification. The instrument has formed the subject of Patents Nos. 15,273, 1900; 20,896, 1900; 24,814, 1901; and 5,971, 1903. Accepted October 12, 1905.

23,202 (1904). **Manufacture of Bullets.** L. B. Taylor, Birmingham. The bullets described in Patents Nos. 13,460, 1899, and 3,897, 1901, are improved upon by eliminating the cap and forming what appears to be a solid conoidal bullet in one piece. It is not solid, length being obtained without increase of weight, by evenly covering a hollow conoidal shaped core of thin metal, with lead to a requisite thickness. Accepted October 26, 1905.

23,872 (1904). **Range Finder.** W. H. Lock and A. H. Pollen. (This Specification is a Secret Document).

24,506 (1904). **Compressed Air Motor Torpedoes.** W. H. Webb, W. G. Brettell, and A. J. Adamson, Liverpool. The range of a compressed air-motor torpedo is increased by drying the air on its way from the compressors to the storage chambers. The formation of snow or ice about the valves, air passages or working ports of the motor is in this way prevented. Accepted October 12, 1905.

25,201 (1904). **Gun Mountings**. Sir W. G. Armstrong, Whitworth & Co., Ld., and A. G. Hadcock. Newcastle-on-Tyne. The gun or howitzer and its cradle are balanced on trunnions with the gun below and the cradle above, the trunnion being considerably above the gun axis. When the gun recoils a rotary movement is produced and the angle of elevation is reduced. Accepted October 5, 1905.

25,526 (1904). **Feed Mechanism of Automatic Guns**. A. T. Dawson and G. T. Buckham, London. The cartridge-belt feeding block of automatic guns of the "Maxim" type is provided with feed and retaining pawls, which are adapted simultaneously to be moved out of contact with the cartridge-belt when the belt is to be withdrawn from the gun. Accepted October 12, 1905.

26,288 (1904). **Electrical Training for Ordnance.** Vickers, Sons & Maxim, Ld., A. D. Williamson, and C. L. Sumpter, Sheffield. A shunt or compound-wound electric motor is employed for training and elevating heavy ordnance. Accepted October 5, 1905.

26,362 (1904). **"Paradox" Bullets**. H. W. Holland, London, and J. Woodward, Willesden. In order to procure steadiness during the flight of the bullet used in the "Paradox" ball and shot-gun, its length is increased but not its weight. A solid ogival cap of wood, papier-mâché, or aluminium is affixed as a nose to a base of solid lead. Accepted October 5, 1905.

26,377 (1904). **Working of Ordnance.** A. T. Dawson, London, and J. Horne, Barrow-in-Furness. The recoil cylinder of heavy ordnance is provided with a second retarding cylinder and piston, the duty of which is to control and retard the recoil movement of the gun and bring it to a smooth and gentle stoppage as it completes its running out. Accepted October 5, 1905.

26,476 (1904). **Back Sight for Rifles**. J. Mitchell and J. Hodgson, Toronto, Canada. A back sight of the leaf type, upon which slides a cross bar. The bar may be adjusted laterally to counteract side divergence of the bullet. When in the horizontal position the bar, no matter in what position on the leaf, is always the same height above the barrel axis. Accepted October 12, 1905.

26,762 (1904). **Field Gun Carriages.** A. T. Dawson and G. T. Buckham, London. A separable gun carriage, particularly suitable for use in mountainous country, is set out in this patent. Light draught shafts may be attached so that the gun may be moved on its own wheels. Accepted October 12, 1905.

26,967 (1904). **Magazine Charging Clip**. L. S. Hollings, Birmingham. A cartridge-holder for charging rifle magazines is provided along the top of each side with an inwardly projecting longitudinal bead or rib adapted to bear against the sides of the cartridge and so form runners for them. Accepted October 12, 1905.

27,459* (1904). **Nitrate of Ammonia Explosive**. L. Lheure, Paris.

27,460 (1904). **Priming of Explosives**. L. Lheure, Paris. A method of exploding the less sensitive of explosive compounds, consisting in intensifying the action of the primer by priming the charge for the whole or best part of its depth by means of a detonating fuse or fuse cord, which receives its ignition directly from a fulminate of mercury detonator or from another detonating tube of less diameter extending out of the shot hole. Accepted October 19, 1905.

27,581 (1904). **Telescopic Sights for Ordnance**. A. König, Germany. A telescopic sight for ordnance is so arranged that the gun layer may aim at objects situated in opposite directions without altering his direction of vision. Accepted October 26, 1905.

28,041 (1904). **Detonator for Blasting.** Col. R. H. F. Rennick, India, and Aerators Ld., London. A charge of gunpowder situated in a strong but brittle metal bulb takes the place of the ordinary fulminate of mercury detonator. The powder when fired by electricity bursts the bulb and ignites the main charge. Accepted October 26, 1905.

28,189 (1904). **Targets**. Capt. A. B. Carey, R.E., Hythe. Two targets are supported by carriers of exceptional strength, which are suspended and guided on a frame and counterbalanced so that when one target is exposed the other is lowered and protected. Accepted October 12, 1905.

216 (1905). **Torpedoes**. G. W. Bell, Hayle, and F. M. Hale, Catford, London. A locomotive torpedo, a front portion of

which is adapted to be broken away upon impact so as to allow the front end of the explosive charge to move forward into close proximity to the object. Accepted October 19, 1905

640 (1905). **Armour Piercing Projectile.** A. T. Dawson and L. Silverman, London. A flanged projectile cap is furnished on its inner wall with a lining of studs composed of soft metal. A machine is provided for pressing this cap on to the nose of the projectile so that the studs become embedded in the roughened surface of the nose. Accepted October 12, 1905.

1,223 (1905). **Ordnance Breech Mechanism.** A. T. Dawson and G. T. Buckham, London. Improvements in the breech mechanism of the guns of the type in which the breech is closed by a transversely-sliding block, the firing being effected by gear of the slip-lock pattern set out in Patent No. 22,078, 1903, are described in this specification. Accepted October 5, 1905.

3,033 (1905). **Ordnance Projectiles**. H. Stanbridge, Sheffield In the manufacture of hollow-forged projectiles, a process is described of obtaining the required thickness of base, which is forged over the fuse body in such a way as to prevent its being blown out without an initial rupture of the base itself. Accepted October 19, 1905.

3,804 (1905). **Gun Carriages**. A. T. Dawson and G. T. Buckham, London. In Patent No. 18,261, 1904, automatic recoil cut-off gear was described, applicable only in the case where the trail and carriage participated in the training movement of the gun. The present patent deals with a method actuating the cut-off gear even when the gun is arranged to be trained independently of the trail and cradle. Accepted October 12, 1905.

4,101 (1905). **Trigger Mechanism of Automatic Arms**. Lt. J. T. S. Schouboe, Denmark. By means of a stop the movement of the trigger of an automatic arm is limited. Remove the stop and the gun may be discharged continuously by the longer trigger-pull. Return the stop and the trigger has to be pulled for each shot. Accepted October 5, 1905.

4,472* (1905). **Single-Trigger Mechanism**. W. Evans and W. Corrie, London.

4,922 (1905). **Ordnance Breech Mechanism.** W. Beardmore & Co., Ld., and A. Bremberg, Glasgow. The breech mechanism of ordnance of the type in which a laterally moving breech-block is operated by a lever centred upon the breech is modified in order to simplify and improve its action. Accepted October 19, 1905.

4,968 (1905). **Manufacture of Explosives.** J. C. Gonsalves, Colombo, Ceylon. In explosive compounds containing nitroglycerin which require an absorbent, cocoanut fibre, or coin dust is used for the purpose. Accepted October 19, 1905.

5,254 (1905). **Back Sight for Rifles.** M. E. Sutherland, Canada. An improved form of the leaf sight described in Patent No. 20,269, 1902, is dealt with in this specification. The sight is capable of being very finely adjusted both for elevation and wind, but it may be quickly set for rough range when time necessitates. Accepted October 19, 1905.

6,045 (1905). **Manufacture of Explosives.** A. C. Girard, Paris. An explosive compound is produced by mixing two explosive nitro- or azo-compounds in the proportion of their molecular weights, and melting them together on a water bath. The minimum melting point is always obtained by mixing the compounds in the proportion of their molecular weights. Accepted October 19, 1905.

6,299 (1905). **"Rapid Fire" Ordnance**. H. H. Lake, London (Agent for *United States Rapid Fire Gun and Powder Co., U.S.A.*) A number of features are described in connection with "rapid fire" ordnance, among which may be mentioned the inclined guides which cause the breech-block to move at an angle to the gun when the breech is opened. Accepted October 12, 1905.

8,065 (1905). **Armour Piercing Projectiles.** E. Jones, Perry Barr, and Kynoch Ld, Birmingham. A cap for armour piercing projectiles is so shaped that the metal is massed about the point of the projectile so as to offer the greatest support to the point at the time of entering the armour plate. Accepted October 19, 1905.

12,754 (1905). **Telescopic Sight**. J. J. Fric, Germany. Within a telescopic tube is arranged a glass thread which receives all the light from its thick end, and so assumes an illuminated appearance. It is adjustable within the tube and is lighted at night by a small electric lamp invisible from the outside. Accepted October 12, 1905.

13,385 (1905). **Sporting Gun Lock Mechanism**. F. Dupont and H. Schoonbroodt, Belgium. The parts in the lock of an ordinary sporting gun are reduced to two—the hammer and the part which combines the functions of main spring, sear and cocking dog. Accepted October 12, 1905.

13,453 (1905). **Percussion Fuse for Shells**. C. P. Watson, U.S.A. In the mechanism of an impact fuse a hinged barrier is interposed between the hammer and the detonator cap. A movable firing pin is operated by the hinged barrier when the latter is acted upon centrifugally. Accepted October 5, 1905.

13,668 (1905). **Ordnance Breech Mechanism**. A. P. Jones, London (Agent for *The Bethlehem Steel Co., U.S.A.*). In Patent No. 18,898, 1904, was described a method of closing the circuit of the electrical firing devices of ordnance while manipulating the hand wheel which governs the elevating mechanism. By the present invention, the circuit closer is entirely enclosed within the handle so that there are no projecting parts liable to breakage. Accepted October 12, 1905.

14,223 (1905). **Automatic Magazine Rifle**. J. Lauber, Austria. The pulling and return of the trigger practically work the mechanism of an automatic gun. Part of the breech chamber drops downwards when a spring returns the trigger to its normal position, whilst the pull for discharging the rifle replaces it and automatically feeds and fires a fresh cartridge. The magazine is of C-shape and almost encircles the breech. Accepted October 19, 1905.

14,528 (1905). **Ordnance Shield Attachment**. Fried. Krupp, Ag., Germany. To reduce as much as possible the strain on the protective shield of travelling ordnance and on its connections with the axle, it is attached at four points to the wheel axle; but two of these points of connection—one upon each side of the body of the carriage—are formed elastically. Accepted October 12, 1905.

16,894 (1905). **Illuminated Sights for Small-Arms**. Dr. F. A. Schanz, Germany. A device for sighting, consisting of a mirror which takes the place of an ordinary foresight, and a transparent or translucent shield acting as a backsight. The shield is reflected on the mirror. Daylight or the light from a small electric lamp is reflected on to the shield by a prism arranged just behind it. The electric batteries are carried in the stock. Accepted October 12, 1905.

17,710 (1905). **Double Time Fuses for Projectiles**. Rheinische Metallwaren und Mf., Germany. The igniting charge rings in double time fuses are liable to become deformed on account of the concussion on firing. This patent described a support for the weakened channelled parts of the fuse, the support taking the form of a cap or ring of stronger material which is designed to take the concussion. Accepted October 5, 1905.

17,741 (1905). **An Explosive Coherer Powder** F. Schneider, Germany. To the filling material described in Patent No. 28,102, 1902, is added a proportion of gunpowder or blasting powder to form a filling for coherer which can be ignited by means of electrical waves. Accepted October 26, 1905.

17,858 (1905). **Ordnance Sighting Gear**. Fried. Krupp, Ag., Germany. In Patent No. 4,735, 1905, a gun having an independent sighting line, and at the same time screw-elevating gear and a sighting device adjustably mounted upon the cradle, was dealt with. These independent sighting arrangements are rendered applicable to barrel-recoil ordnance in which the cradle is capable of being swung laterally for the purpose of imparting traverse. Accepted October 19, 1905

18,898 (1905). **Projectiles for Ordnance**. Fried. Krupp, Ag., Germany. In combination shrapnel and shell projectiles for ordnance, the shell charge usually lies at a distance from the shrapnel fuse, and is discharged only after a certain period has elapsed after impact. The shell charge is by this invention provided with a special percussion fuse of its own. Accepted October 19, 1905.

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* These Specifications are more fully described under "Selected Patents."

TRADE MARKS.

ADVERTISED NOVEMBER 1—29, 1905.

275,917. A device representing a projectile behind which is a roller. Fried. Krupp, Ag., Germany. September 22, 1905.

276,163. The word LINCOLN. To apply to small-arms. Lincoln Jeffries. Birmingham. October 4, 1905.

276,551. The word PERMONITE. To apply to explosive substance. The Carbonite Syndicate, Ld., London. October 19, 1905.

REGISTERED OCTOBER 19—NOVEMBER 22, 1905.

275,186. The Commercial Investment Corporation, Ld.

SELECTED PATENTS.

NITRATE OF AMMONIA EXPLOSIVE.

27,459 (1904). L. Lheure, Paris. This specification deals with a method of exploding nitrate of ammonia, or other substances which are only slightly sensitive.

A fuse or fuse-cord of sufficiently large diameter is introduced into the charge of nitrate of ammonia for the whole or for part of its length. This fuse is capable of being excited either directly by a detonator of fulminate of mercury placed in the charge or through the medium of a fuse or cord of smaller diameter extending from the shot-hole, which receives its ignition from outside. The tamping of the explosive must be done in as careful a manner as is possible in order to render the explosion complete.

The nitrate of ammonia may be employed either in a pulverulent state, or in crystals, or in the form of compressed cartridges In the last-named case the cartridge should be provided with a central or lateral hole for the passage of the detonating cord. An advantage connected with the use of nitrate of ammonia in fiery mines is the low temperature of detonation of this salt. Accepted October 19, 1905.

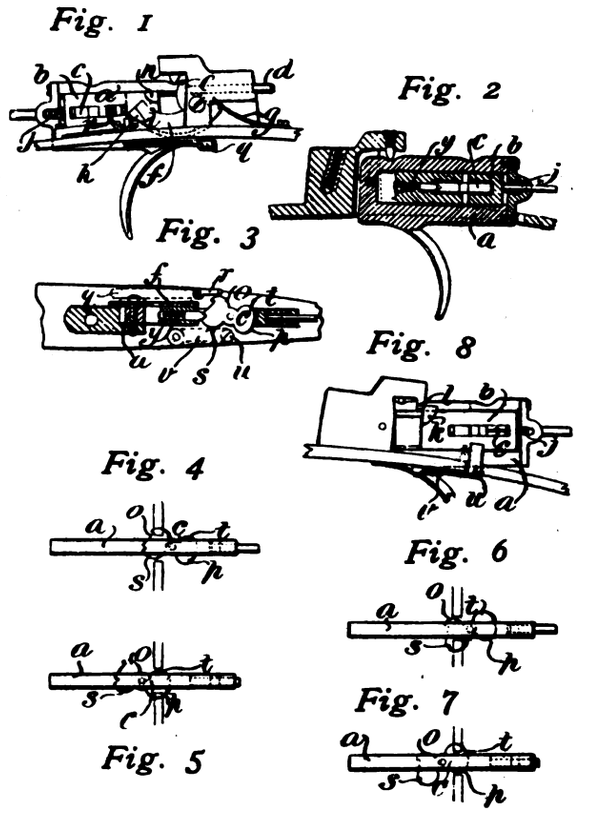
THE EVANS SINGLE-TRIGGER MECHANISM.

4,472 (1905). W. Evans and W. Corrie. Within the only trigger in this system of single-trigger mechanism is arranged a sliding part which carries the sear-lifting limb. This sear-lifting limb may be turned to a position beneath either sear, so that either barrel of a double-barrelled gun may be first discharged. The second barrel, be it either the right or left, is discharged in the ordinary way by the second voluntary pull. The involuntary pull, which follows on the recoil of the first discharge, passes off harmlessly, whilst the sliding part referred to is moving from one position to another

The mechanism is illustrated in the drawings which are reproduced upon this page. Within the rectangular space provided in the trigger-blade *a* is arranged the sliding-part *b*. This part *b* (Fig. 2) carries the pivoted sear-lifting part *c*, the various positions of which are shown in the Figs. 4 to 7. The part *b* is adapted to slide backwards and forwards within the slot in the trigger blade. When the ordinary top lever of the gun is turned to open the breech, the rod *d* is pushed rearwards. Its end abuts against the horn *e* of the lever *f*, and the latter is turned upon its pivot against the pressure of the spring *g* into the position illustrated in Fig. 1. During this movement the free end of the lever *f* bears against the projection *h* on the sliding-piece *b* and so pushes this part rearwards. With the completion of the rearward movement the bent *i* in the free end of the lever engages the lower part of the projection *h* and retains the sliding-piece in this position. The light spring *i* holds the two in engagement.

When the trigger is pulled to discharge one of the barrels, a projection *k* (Fig. 8) on the left-hand side of the sliding-piece abuts against the stop *l*, and the continued lifting of the trigger forces the sliding-part *b* still further rearwards. The bent *i* in the lever *f* is in this manner disengaged from the projection *h*. Under the influence of the spring *g* the freed lever *f* is turned upon its pivot and is so caused to engage a second projection *u* and to return the sliding-part *b* to its forward position when the trigger is released. During this forward travel the involuntary pull occurs, and the sear-lifting part *c* not having reached its position beneath the second sear, is rendered abortive.

The sear-lifting part *c* is clearly illustrated in Figs. 4 to 7. Assuming that it is in the position illustrated in Fig. 4 when the sliding-part is retracted, the right-hand barrel will be first discharged through the shoulder *o*. When the sliding part moves



forward after the first discharge, the shoulder *p* is carried beneath the left-hand sear as is illustrated in Fig. 5. When it is desired to discharge the left-hand barrel first, the sear-lifter *c* is turned over upon its pivot after the mechanism is cocked through the medium of the external thumb-piece *q*. When this thumb-piece is moved forward the beak *p* attached thereto comes against the shoulder *o* and turns the part *c* about its pivot Then when the trigger is raised the shoulder *s* lifts the left-hand sear first (Fig. 6), and when the slide moves forward the shoulder *t* is taken beneath the right-hand sear (Fig. 7), which is lifted with the succeeding voluntary pull.

When the gun is broken down for re-loading after the left-hand barrel has been discharged first, the stop *u* on the left-hand side of the trigger (Figs. 4 and 9) returns the sear-lifter to its position shown in Fig. 4, unless the stop is removed by operating the exterior thumb-piece *v*. Should the stop be removed then the left and right order of firing prevails until it is returned. The sear-lifter *c* is held in either position by the spring-bolt *y*. Accepted October 19, 1905.